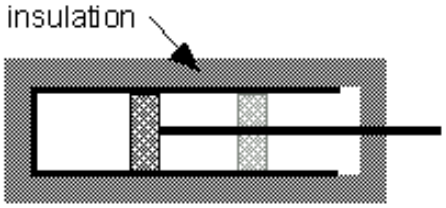


A sealed cylindrical pump contains one mole of an ideal gas. The piston fits tightly so that no gas escapes, but friction is negligible between the piston and the cylinder walls.

The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*There will be be the same amount of stuff in a smaller space so the molecules will bump each other more frequently and there will be more friction between them.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

7. Explain: *As the gas molecules move more rapidly, they lose energy as heat.*

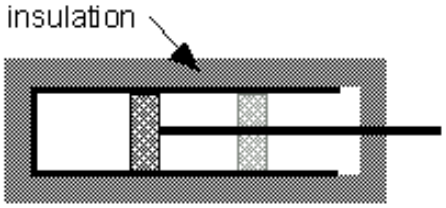
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *not enough information is given to determine the change in temperature*

9. Explain: *It depends on what you mean by slowly. Even if the gas is initially very cold, after you push the piston there is still the same amount of stuff in a smaller place.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *Any heat left would be transfered to the colder ice water*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*The gas is compressed, energy from combustion is formed*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *The pump is thermally insulated*

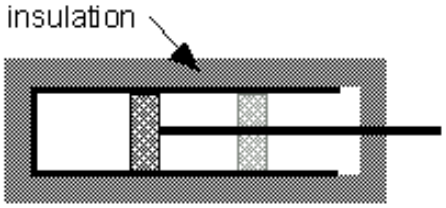
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *The gas is compressed themolecules collide into one another more often.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *The heat is transferred from the gas to the uninsulated cylinder to the icewater, because the system is not yet at eqiulibrium but is getting there.*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will remain the same*
5. Explain:*pressure is increasing but volume is decreasing at the same time*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *it is in an insulated system*

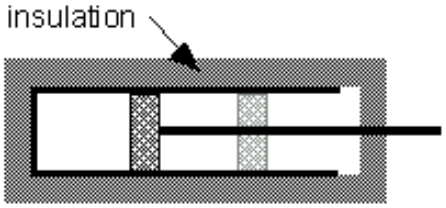
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will decrease*

9. Explain: *due to a heat transfer*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *the ice water takes heat away from the pump*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*when you compress a gas the byproduct is heat*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

7. Explain: *heat will be transfered to the piston to try to find an equlibrium*

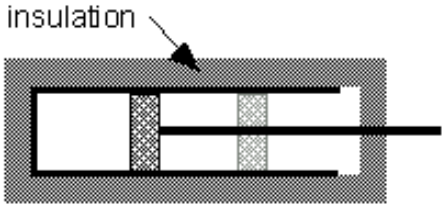
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *the temperature will still increase because you are still compressing the gas*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *heat from the gas will still be transferred to the piston*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*When pressure increases and volume decreases then temperature must incease to keep system in equilibrium*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred into the gas during this process

7. Explain: *Mechanical energy is converted into thermal energy in the gas*.

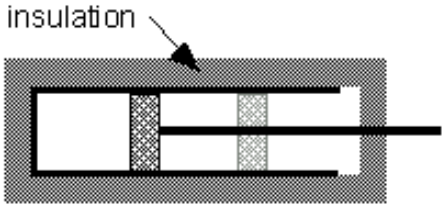
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *The heat generated by compressing the gas tranferes to the liquid*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *From gas through cylinder wall and into water*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will decrease*
5. Explain:*Directly related to volume*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *because you are not changing the internal conditions*

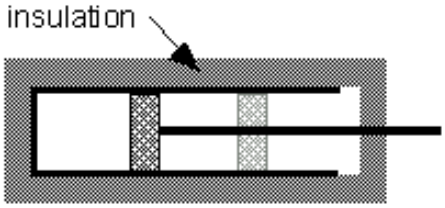
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will decrease*

9. Explain: *because it has to adjust to surroundings*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *The water is cooler*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*The pressure will build and so wil the temp*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *It is insulated*

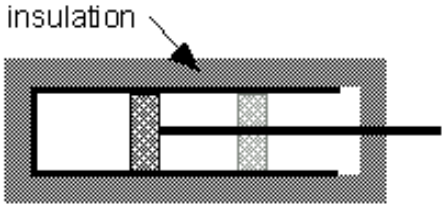
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain:

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred in to the gas during this process

11. Explain:



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*The atoms will be interacting closely together*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *The heat is coming from interaction not transfer*.

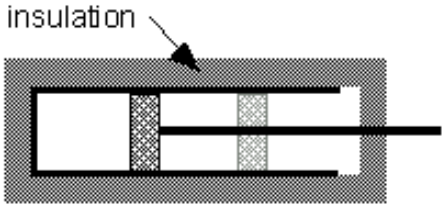
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will decrease*

9. Explain: *The system's temperature will decrease due to the ice*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *The heat from gas is being transfered into the water*.



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*The temperature increases because the pressure increases*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *The temperature increases because the pressure increases, not because heat is transferred from another object*.

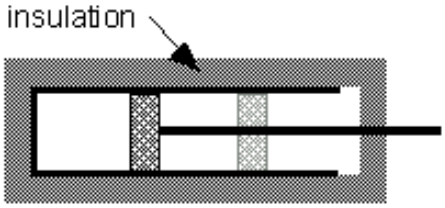
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *Even though the pressure is increasing, the ice water will prevent the temperature from rising*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *Heat it transferred out of the gas so the system can come to thermal equilibrium*.



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4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*temo increases with pressure*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred into the gas during this process

7. Explain: *work is done on it*

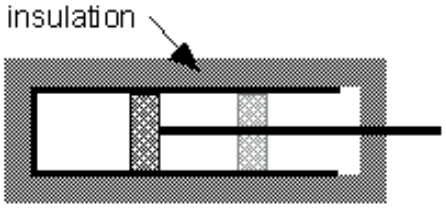
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will decrease*

9. Explain: *all heat will be lost to ice water*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *heat goes from gas to water*



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4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*PV=nRT, P and T are directly proportional*.

as P goes up, T go up as well

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *Since it is insulated*.

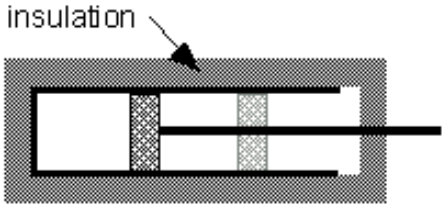
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *Since Pressure is increased very slowly, Temperature is too*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred in to the gas during this process

11. Explain: *Since Temperature of gas increases, the heat is transfered from somewhere into the gas*.



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4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*pv=nrt*

t = pv/nr

p increases, so t increases

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred into the gas during this process

7. Explain: *The temperature increases, so yes*

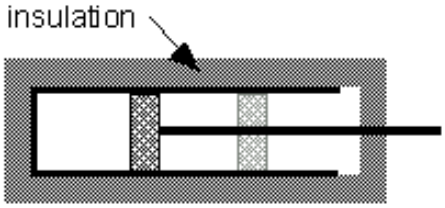
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *Same reason as above. The ice water also will come into equilibrium with the hotter gas and both will be warmer than 0c*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred in to the gas during this process

11. Explain: *The gas increases in temp, so there must be heat*



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4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*the volume is decreased, and pressure increases. so there will be more collisions between molecules so the temperature will increase,*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred into the gas during this process

7. Explain: *transfered from outside to inside with the gas*

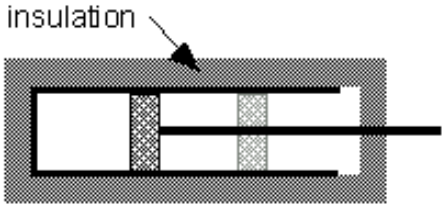
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *more pressure so higher temp*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred in to the gas during this process

11. Explain: *heat tranfers to gas*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*All the energy of the volume is concentrated into a smaller volume, the temp increases*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *No other sources from which heat is transferred*

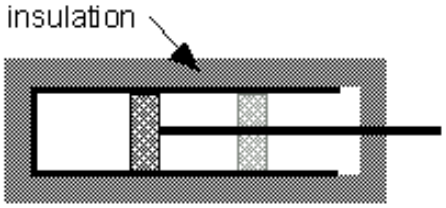
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *all temp increase that would have existed is lost to the surrounding water*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *out of gas and through the cylinder into the water*



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4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*As pressure increases so does the temperature according to the thermodynamics equestion for ideal gases*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *Because of the insulation the heat gained by the gas will have nowhere to go so it will not be transfered*.

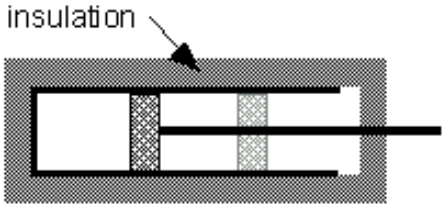
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *It will increase for a second and then the temperature will disipate into the water and create a new equilibrium temp*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *The temperaute is going to be pushed from the gas into the water since there is no insulation to keep the heat from being transfered*.



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will remain the same*
5. Explain:*PV=nRT. If the volume decreases then the temperature remains the same, but the pressure will increase*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *The temperature doesn't get hotter or colder*.

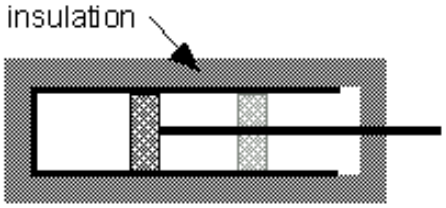
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *PV=nRT. The temperature will increase because work is being done to the system and because it is not insulated*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred in to the gas during this process

11. Explain: *Because the temperature increases because of the work done to the system, heat transfers to the gas during this process*.



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*more pressure does more work, work produces energy therefore heat*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

7. Explain: *i don't remember why*

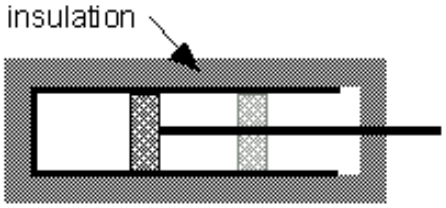
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *has to do with work/energy/chemistry*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *I still don't remember*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*When the pressure increases so does the temperature because Temperature is the only dependent variable on the right side of the equation and would have to make up for the increase in pressure.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *There is no heat transfer from anywhere.*

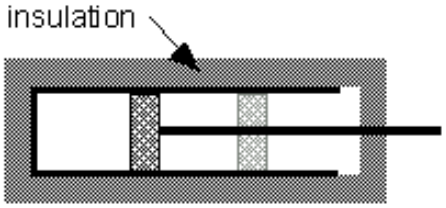
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *Because the pressure increases, so does the temperature.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred in to the gas during this process

11. Explain: *Heat it tranferred into the gass as pressure is applied.*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will remain the same*
5. Explain:*Although temperature of the gas is related to its pressure and volume, in this case, the temperature shouldn't change. The pressure will increase, however.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *The temperature of the gas doesn't change so there is no heat transfer.*

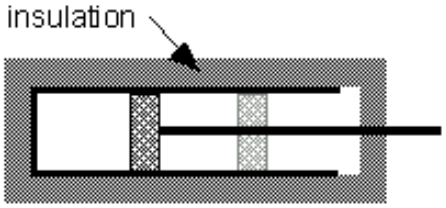
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *Same as above: pressure increases but temperature stays the same.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer occurs during this process

11. Explain: *The system is in equilibrium. Everything is the same temperature so no heat transfer can occur.*



A sealed cylindrical pump contains one mole of an ideal gas. The piston fits tightly so that no gas escapes, but friction is negligible between the piston and the cylinder walls.

The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*There is the same volume, but the pressure changes, so the temperature must change too. Since pressure goes up, so does the temperature.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred into the gas during this process

7. Explain: *Since it heats up, the gas must get heat transferred to it from the pressure.*

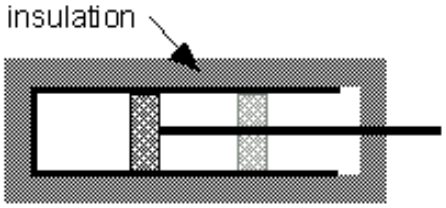
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *Since it is in equilibrium and then the pressure changes, the temperature changes too.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred in to the gas during this process

11. Explain: *Since the heat increases, there must be heat transferred to it.*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*If pressure increase but initial volume of gas remains constant (that is to say none ecapes) the e4quation for thermal states would indicate a responsive to increase in heat.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *In this case heat is not transferred from one object to another. The increased heat results from the acceleration of particles due to increased pressure.*

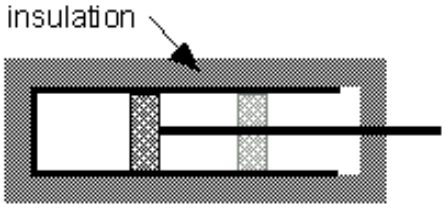
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will decrease*

9. Explain: *Decreased pressure will first cause the particles to slow and create less frictional heat. Indroduction to a colder environment will also provoke heat transfer.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *Heat flows from hottest to coldest, if the gas is comparatively warmed than the water surrounding it the heat will dissipate as it moves from the gas to the water.*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will decrease*
5. Explain:*I used the equation PV = nRT*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *heat is generated as a result of the work done by the gas*.

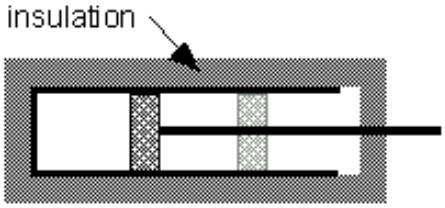
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *as the piston compresses the air heats but the heat is lost to the outside because it isn't insulated*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *heat is generated, but is lost to the ice water because the piston isn't insulated*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*As density increases, the molecules of gas get closer together and make each other hot.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *Because heat isn't being transferred from one thing to another.*

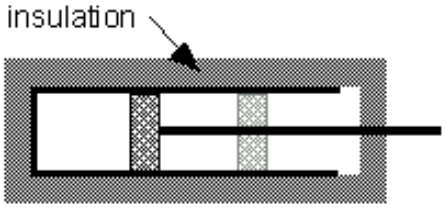
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *Same as (5).*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred in to the gas during this process

11. Explain: *When the piston is pressed inward, the gas molecules gain heat.*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will decrease*
5. Explain:*PV=nRT*

T=PV/nR

as V decreases, T decreases.... Directly proportional

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

7. Explain: *The temperature of the gas decreases, which means it lost heat, which must have gone to its surroundings, or the piston walls...?*

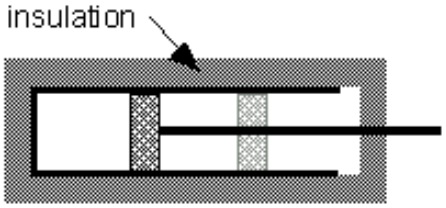
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will decrease*

9. Explain: *The temperature of the water does not affect the temperature of the gas because the piston is thermally insulated. The temperature of the gas must then decrease.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *The temperature of gas decreases, to heat is transferred out of the gas during this process.*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*the molecules will bump into each other more, friction increases heat*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *heat transfer is prevented by the insulation*.

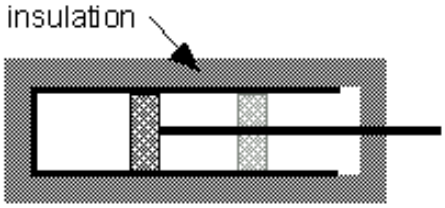
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *heat is lost to the surrounding icewater*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *Is self evident*.



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*as the pressure increases, so does the temperature*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred into the gas during this process

7. Explain: *The heat is transferred into the gas in order to heat it up*

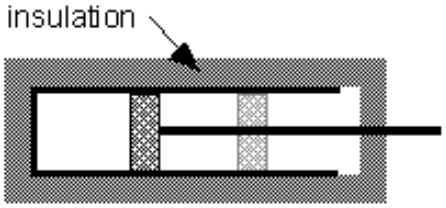
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *Because as the pressure increases, the temperature is transferred to the water*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *The heat is transferred out of the gas into the water*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will decrease*
5. Explain:*because the temperature and the pressure are inversely proportional*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

7. Explain: *because the delta T is negative therefore the process is exothermic*.

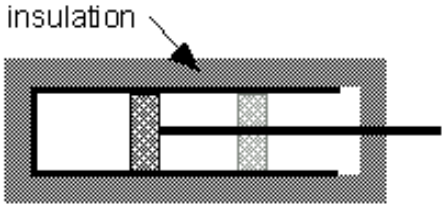
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will decrease*

9. Explain: *because the temperature and the pressure are inversely proportional*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *because the delta T is negative therefore the process is exothermic*.



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*The volume of the container decreases while the amount of gas stays the same. That energy goes into producing heat.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred into the gas during this process

7. Explain: *The gas becomes hotter therefore it receives heat.*

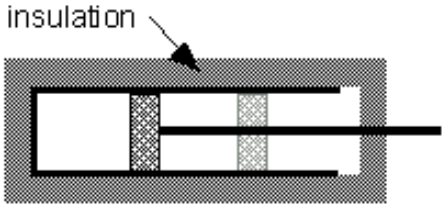
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *The piston creates heat because it compresses the gas.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred in to the gas during this process

11. Explain: *the gas's temperature increases therefore it receives heat.*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*because as the pressure inside the pump increases the temperature will also increase*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred into the gas during this process

7. Explain: *for there to be a change in the thermal states of the gas there must be heat transfer due to the work being done to the gas*.

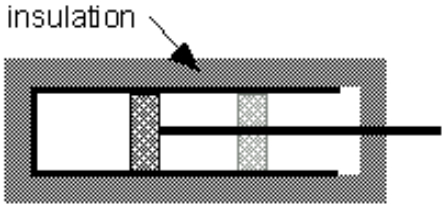
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *because of the same reasons as above*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred in to the gas during this process

11. Explain: *same as the answer above but the temperature is lower due to the pump being in cold water without insulation*.



A sealed cylindrical pump contains one mole of an ideal gas. The piston fits tightly so that no gas escapes, but friction is negligible between the piston and the cylinder walls.

The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*More molecules in a smaller space means more collisions between atoms, so more heat produced, and sinse it is insulated the extra heat will stay there, thus heating the system up.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *insulated?*

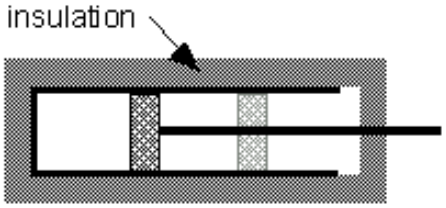
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *well if the piston is pushed slowly, then the heat produced will be greater in the gas and so without insulation will transfer to the cooler water, heating the water up and cooling the gas to stay at equilibruim.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *see above*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*The molecules collide more and produce more heat.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *The only external force that would give heat would be friction and that is negligible in this case.*

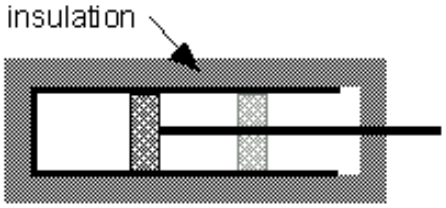
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *After being at equilibrium, the piston does work and produces heat as in the first example.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *Heat is transfered into the water and raises the temperature because there is no insulation.*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will remain the same*
5. Explain:*the temperature will not change because when the volume decrease but the pressure increases. There is no change in temperature.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *Since the temperature does not change there is no heat transfer.*

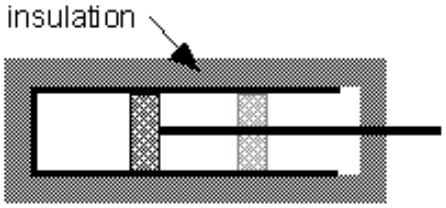
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will decrease*

9. Explain: *the temperature will decrease because of the ice water. It will become colder.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *there is heat transferred out of the gas during this process because the gas will be colder and ice water will melt. There is heat coming out of the gas.*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will remain the same*
5. Explain:*Cannot loose or gain heat, it is well insulated.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *It is well insulated.*

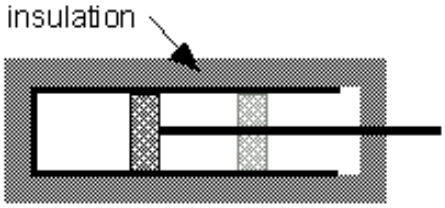
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *It changes because work done to the system, do not need to change the temperature.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer occurs during this process

11. Explain: *Volume changes due to work on system, not heat transfer.*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*pv= MCT*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred into the gas during this process

7. Explain: *to the gas by the work of the piston giving more pressure to the gas*

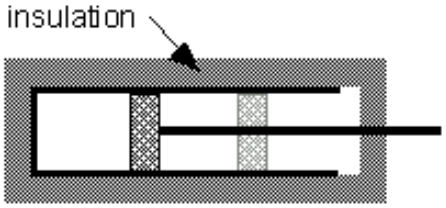
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *same as before*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred in to the gas during this process

11. Explain: *same as before*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*Since pressure increases, temperature also has to increase.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred into the gas during this process

7. Explain: *Since the temperature is increasing, heat has to be transferred into the gas.*

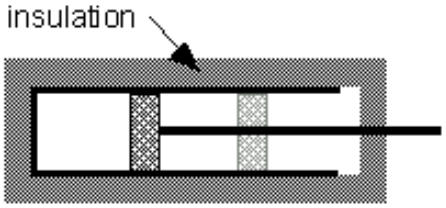
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will decrease*

9. Explain: *It is now a solid. SInce pressure increases, temperature has to decrease.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *Since the temperature is lowered, heat is transferred out.*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*in the gas equation temperature is proportional to the pressure so when they pressure is increased the temp will also increase*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *The heat is coming from the atoms and their interactions but if the capsule is insulated then there should be no heat transfer*.

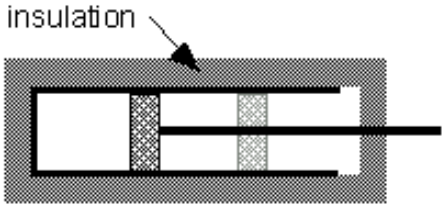
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *The temperature of the gas will still increase, the gas shouldn't act differently just because it is colder now*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *if there is heat being generated by the gas then the system will try to reach equilibrium by transferring that heat into the cold water and melting some of the ice it there is enough transfer of heat*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will remain the same*
5. Explain:*The pressure will increase and volume will decrease, but there is nothing to change the temperature.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *Due to the insulation, no heat goes into or out of the cylinder or the surroundings.*

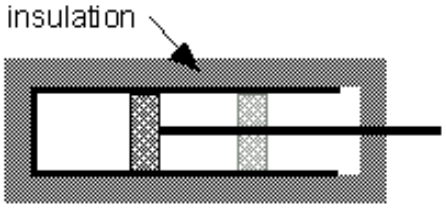
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *It is in equilibrium so same temperature as the water.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer occurs during this process

11. Explain: *Since temperature is constant there can be no heat exchange.*



A sealed cylindrical pump contains one mole of an ideal gas. The piston fits tightly so that no gas escapes, but friction is negligible between the piston and the cylinder walls.

The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will remain the same*
5. Explain:*temperature is independent of volume*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *friction is negligible*

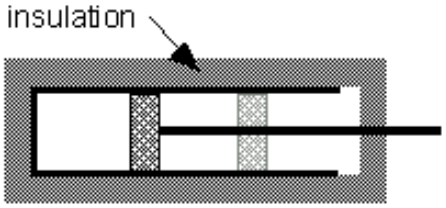
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *it starts at thermal equilibrium, temperature is independent of volume*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer occurs during this process

11. Explain: *no friction*



A sealed cylindrical pump contains one mole of an ideal gas. The piston fits tightly so that no gas escapes, but friction is negligible between the piston and the cylinder walls.

The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will decrease*
5. Explain:*less space = lower temperature*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

7. Explain: *the temperature of the gas decreases*

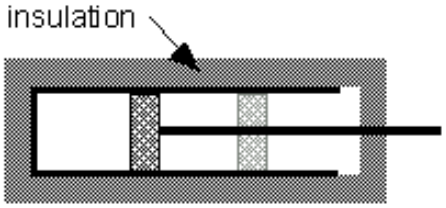
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will decrease*

9. Explain: *compressed gas has lower temperature*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *heat is transferred to the water from the gas*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will remain the same*
5. Explain:*The increase in pressure will change the temperature from the ideal gas law.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *No object is placing heat into the system so there will be no heat transfer.*

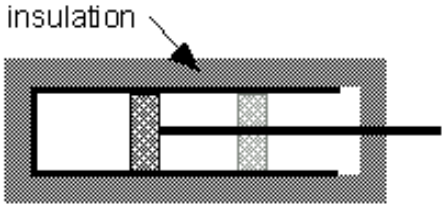
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *The increase in pressure will change the temperature from the ideal gas law.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer occurs during this process

11. Explain: *No object is placing heat into the system so there will be no heat transfer.*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*By the equation PV=nRT.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *The compression of the gas generates the heat it is not transfered.*

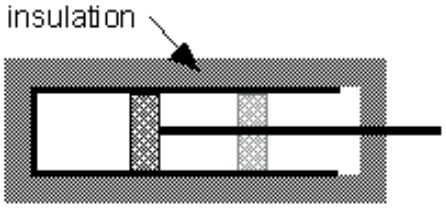
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *Same as before.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *With no insulation the heat is transfered from the gas to the water.*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*the molecules will move faster since the pressure is greater*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *It is an isolated system*.

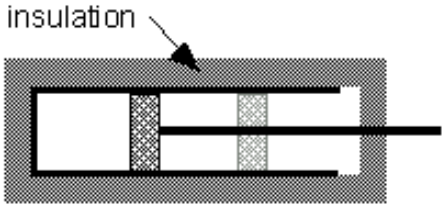
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *any increase in temperature will be dissipated by the ice water*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *there is more heat in the cylinder than outside of it so it will flow out until there is equilibrium*.



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*it will increase because when you raise the pressure the temperature will rise*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *there is no where for the heat to be transfered from*.

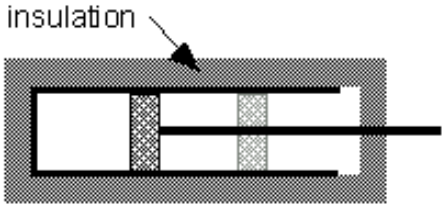
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *it will increase because when you raise the pressure the temperature will rise*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *The heat is transfered to the ice water*.



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *not enough information is given to determine the change in temperature*
5. Explain:*If the molecules in the space are moving in smaller volume they will create more pressure*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

7. Explain:

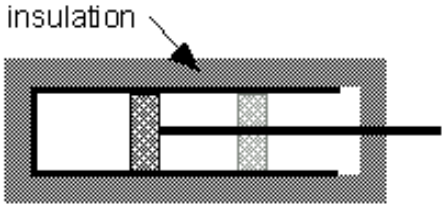
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will decrease*

9. Explain:

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain:



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*Greater pressure would cause an increase in temperature*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *Heat is conserved so there's no transferring*.

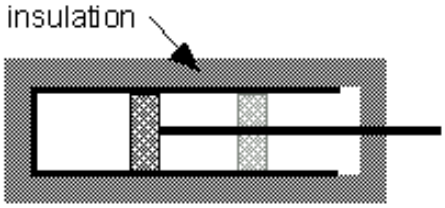
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *If the system decreased then the temperature of the gas must increase to keep it conserved*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer occurs during this process

11. Explain: *Heat is conserved so there is no transferring*.



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*As pressure increases temperature increases*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *There is no external heat transfer in this expiriment. Heat gain is internal.*

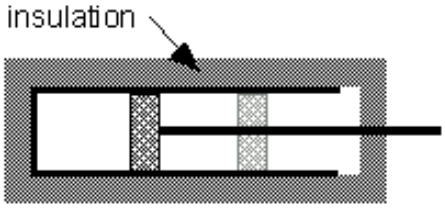
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *not enough information is given to determine the change in temperature*

9. Explain: *The temperature will increases due to higher pressure, but will decrease due to heat lost to the ice bath, we don't know how much though.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *Higher pressure results in higher temp.. which is lost to the surroundings.*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will decrease*
5. Explain:*paintball - C02 tanks they are cold after filled*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

7. Explain: *gets cool*

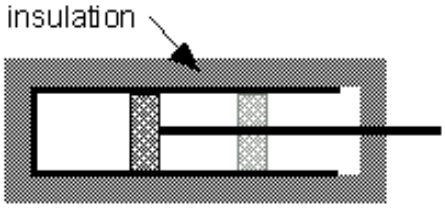
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *system wants to stay in equilibrium*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *surrounding ice water*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will remain the same*
5. Explain:*The volume change and pressure change cancel each other out so that the temperature doesn't change*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *No transfer because I'm assuming that container and gas are the same temperature*

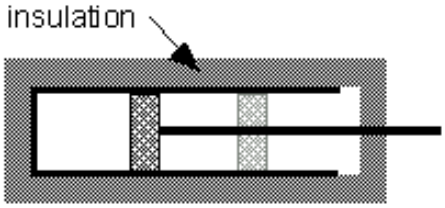
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will decrease*

9. Explain: *Because the heat of the gas will transfer into the ice water*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *Because the heat wants to go into the ice water to make the system at equilibrium*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*greater temp = greater temp*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *isolated system*

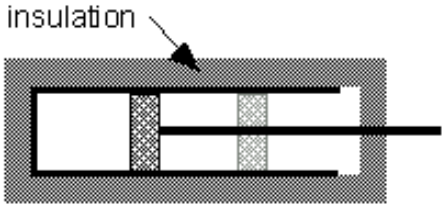
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *assuming change in pressure is none*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer occurs during this process

11. Explain: *because cooler gas is less volume*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*as more air compresses, the molecules collide with each other and generate heat.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
not enough informaion is given to determine how heat is transfered

7. Explain: *we need to know the materials of the piston*

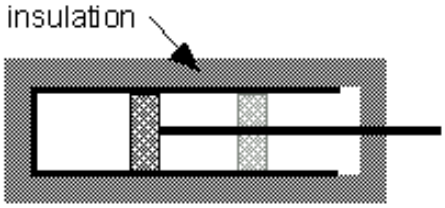
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *with no insulation, the ice water will cancel the heat generated by the piston*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *without insulation, it goes into the water*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will remain the same*
5. Explain:*PV=nRT The volume is going down the pressure increases resulting in no change of temperature*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *Volume increases pressure decreases in such a way that the temperature doesn't change*.

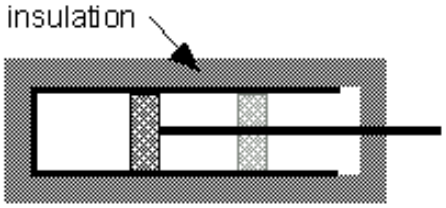
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *The temperature will go up because of friction in the piston*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *The heat will escape inot the water*.



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*If the pressure increases, then according to the equation PV=nRT, temperature must increase as well, because nothing else on the right side of the equation can increase.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred into the gas during this process

7. Explain: *Because the temperature of the gas increases, heat is being transferred into the gas during the process to make the temperature increase.*

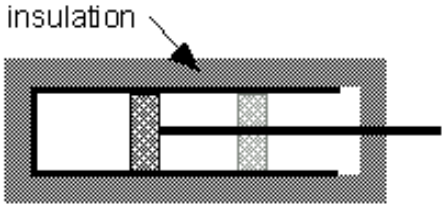
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *Regardless of the surroundings, the pressure of the gas is going to increase, and something in the equation PV=nRT must make up for the increase, therefore the temperature would increase.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred in to the gas during this process

11. Explain: *Heat is still being transferred into the gas because the temperature of the gas is going to increase. Although, it will not increase by as much because of the cold surroundings.*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*The volume of the gas decreases, so the gas molecules would be closer together. This would create more heat as the molecules move around.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *No heat transfers because the pump is thermally insulated from its surroundings.*

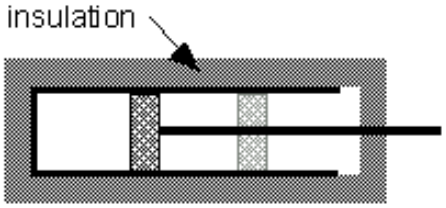
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *The tempeature will remain the same because the pump in the ice waer is at thermal equilibrium.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *The cold water around the pump cools the gas inside the pump.*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will remain the same*
5. Explain:*There is no firction and nothing outside the system effecting it to change the system*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *isolated system*.

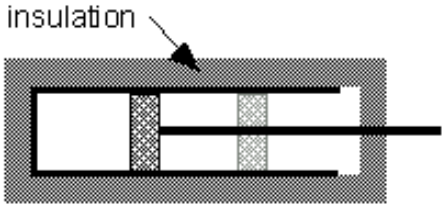
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *it will increase due to the movement, but not very much*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred in to the gas during this process

11. Explain: *The pistons movements will cause the heat*.



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*Temperature and Pressure are directly related from the ideal gas law PV=nRT, so as pressure increases, temperature will increase*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred into the gas during this process

7. Explain: *Work is being done on the system, so heat goes into the system (the gas).*

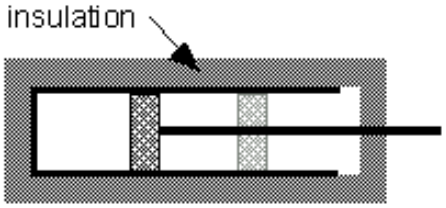
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will decrease*

9. Explain: *The temperature will increase slightly as the pressure increases, but over a short period of time the heat will dissapate and into the ice water, cooling the gas*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *Heat is lost by the system: -q*



A sealed cylindrical pump contains one mole of an ideal gas. The piston fits tightly so that no gas escapes, but friction is negligible between the piston and the cylinder walls.

The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will remain the same*
5. Explain:*Because pressure, volume, and temperature are all related-as pressure increases, volume decreases, so temperature does not need to change*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *the pump is thermally insulated*.

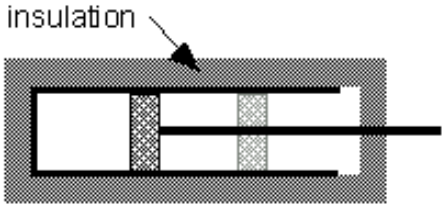
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *Because temperature, volume, and pressure are related and as pressure increases the volume decreases*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer occurs during this process

11. Explain: *The ice water and the pump are already in thermal equilibrium*.



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*Since pressure increases, temperature must also increase*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred into the gas during this process

7. Explain: *Heat energy must be transferred to the gas to increase temperature*.

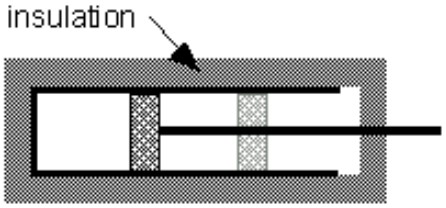
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *The ice-water will cool the gas and cause it to remain in equilibrium*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *Heat transfers from the gas to the liquid*.



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*As pressure increases and volume decreases, the temperature must increase.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *There is no heat transfre if the pump is insulated from its surroundings.*

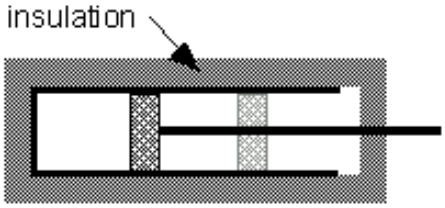
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *The pressure increases and the volume decreases so the temperature must increase.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *The temperature of the gas increases and therefore is transfered to the surrounding ice water which is at a lower temperature*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred into the gas during this process

7. Explain:

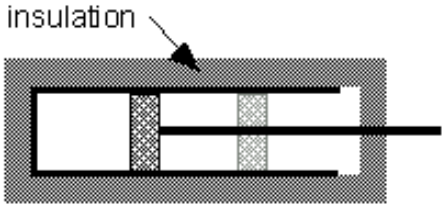
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *any change will equilibrate with the water*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *heat generated by the gas will transfer to the water*.



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*I feel like there will be more collisions between the atoms.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred into the gas during this process

7. Explain: *It is transfered by the force, which is in turn work.*

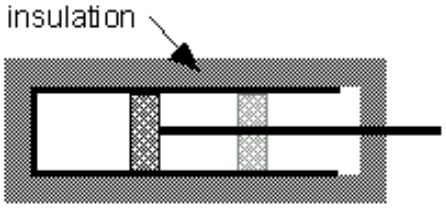
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *Because there is more collisions.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred in to the gas during this process

11. Explain: *Because there is work done. But there might also be heat lost in the ice water.*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*Energy is added to the system so it must come in the form of increased temperature*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *The pump is thermally insulated from the surroundings so there can be no exchange of heat*.

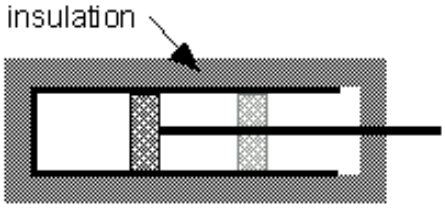
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *The energy used to compress the gas can be transfered and absorbed by the surroundings*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *The heat leaves the gas into the surroundings*.



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will remain the same*
5. Explain:*The temperature remains the same but the pressure increases and the volume decreases*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *If the temperature remains the same there is no heat transfer*.

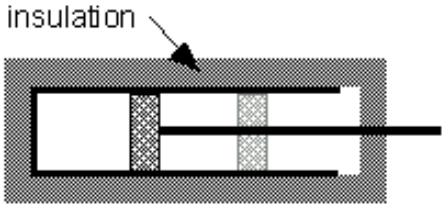
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will decrease*

9. Explain: *The ice water in the surroundings of the container will cause the temperature of the gas to decrease*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *Heat is transferred out of the gas because the temperature of the gas is decreasing. The heat will cause the temperature of the ice water to change by a very small amount*.



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*As the pressure increases, the temp increases*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *the heat is created from the pressure*

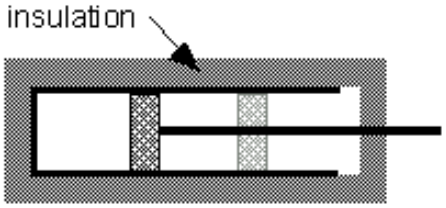
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *the heat that is created dissipates because the piston is pushed slowly, the system reaches equilibrium quickly*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *the gas creates heat and its then transfered to the ice water to reach equilibrium*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*The tempurature of the gas will increase since PV=nRT. So the increase in pressure will result in a increse in tempurature.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

7. Explain: *The heat from the gas transfers to the piston and hte pump but no where else because it is insulated.*

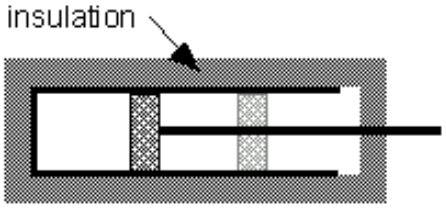
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *It will stay the same since it is pushed in vary slowly that it will stay at equilibrium but heat will be released into the water.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *It comes out of the gas and into the water since the the pressure is being increased.*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*The temperature of the gass will increase due to the fact that pressure increase leads to temperature increase*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *The piston and the surrounding casing are not hot and transfering heat to the gas and the gas does not make the casing or piston cold so there is no heat transfer*.

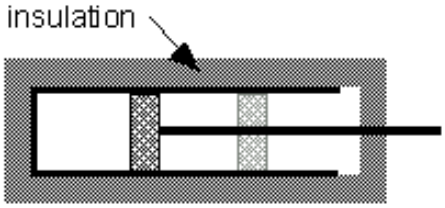
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *With the piston not having the heat insulation there will be rise in temperature still due to the fact that the piston will increase in heat and increase the ice water around it*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *The heat transfer is out of the gas because it will heat up with the increased pressure and then the heat will radiate out causing the water to warm up*.



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will remain the same*
5. Explain:*Temp is independent dependent of volume and pressure*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred into the gas during this process

7. Explain: *There is compression of the gas so there is heat being trasfered*

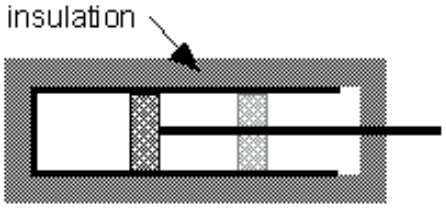
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *temp is dependent on volume and pressure due to the equation of solids*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred in to the gas during this process

11. Explain: *the temp goes up so heat is being added to the gas*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*The energy in the gas will be placed in a smaller volume to the heat will increase*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *The system is isolated so no heat is being transferred*.

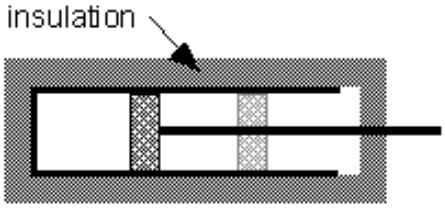
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *The gas will heat up but the heat will transfer into the water though*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *Yea! it goes into the water and they find a new equilibrium*.



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*PV=nRT*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *The heat change is within the molecules of air*.

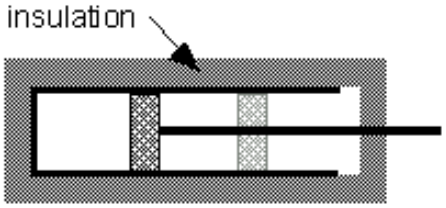
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *The heat will transfer into the ice water*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *Since there's no insulation, the heat transfers to the water*.



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*Because the pressure is going up and the volume is going down.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *No because the pump is thermally isolated so there is no heat transfer. No endothermic nor exothermic reactions are occuring because of the insulation*

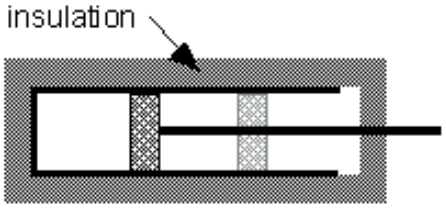
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *Because the temperature of the gas is reaching equilibrium and it surroundings is absorbing the heat*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *because i*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will remain the same*
5. Explain:*PV=nRT. The pressure increases but volume decreases. Temp changes when pressure changes for the same volume.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *The receptical is insulated.*

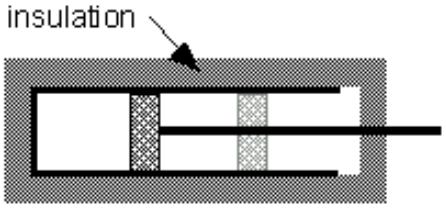
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *Same as question 5.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer occurs during this process

11. Explain: *Pressure increases but volume decreases.*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*Increases the molecules are closer to each other and therefore bounce off each other faster creating heat.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

7. Explain: *Since the molecules bounce giving off heat the heat transfers during the process.*

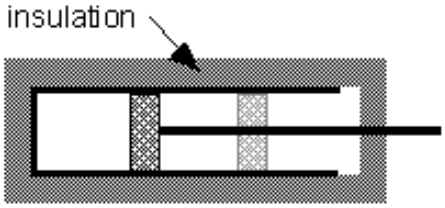
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *You are at 0 degrees there is no heat transfer.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer occurs during this process

11. Explain: *the piston is insulated by 0 degree water. if there is any heat the heat is adsorbed.*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*The volume is decreased thus the temperature and pressure must increase*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *No heat transfer occurs because of the insulation*.

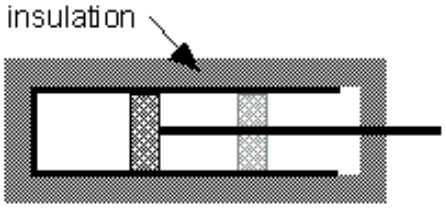
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *The temperature of the gas as well as the water should increase*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *Heat is transfered to the water*.



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*it follows the basic law that as temp increases, pressure increases*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred into the gas during this process

7. Explain: *if the gas gets hotter as temp increases, heat must be transfered to the gas*.

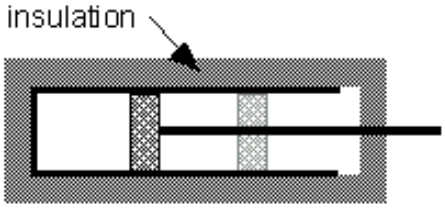
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *pressure is increased, so temperature must increase*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *heat that was in the gas is transfered to the ice water*.



A sealed cylindrical pump contains one mole of an ideal gas. The piston fits tightly so that no gas escapes, but friction is negligible between the piston and the cylinder walls.

The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*The temperature is inversly related to the Volume*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

7. Explain: *the gas tries to come to equilibrium with the outside*

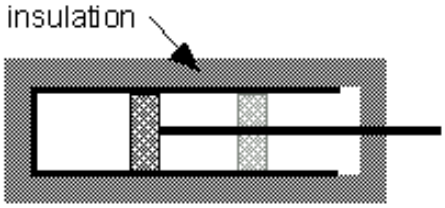
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *Same as before*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *same reason as before*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*if pressure increases temperature will also increase*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *no outside material came into contact with the gas; instead, work was done on it*

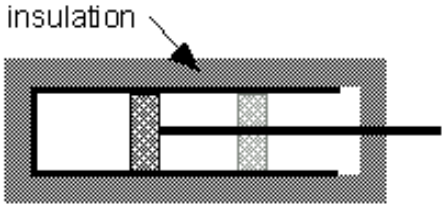
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *the temperature of the gas will increase, but the heat gained will be transfered into the ice water*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *heat moves from warm to cool, so the heat of the gas will be transfered into the ice water*



A sealed cylindrical pump contains one mole of an ideal gas. The piston fits tightly so that no gas escapes, but friction is negligible between the piston and the cylinder walls.

The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will decrease*
5. Explain:*If volume decreases and other variables are held constant, then temperature will decrease*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

7. Explain: *the temperature is lower, so heat has to be transferred*

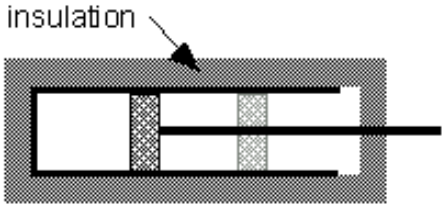
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will decrease*

9. Explain: *the volume is smaller so the temperature has to be lower*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *the temperature of the gas is lower*.



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will decrease*
5. Explain:*because the volume decreased. v0/t=vf/t.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred into the gas during this process

7. Explain: *temperature increased.*

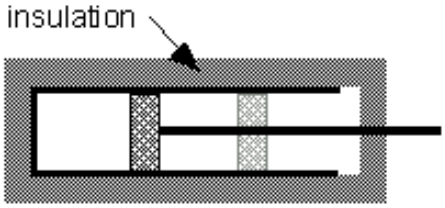
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will decrease*

9. Explain: *when volume decreases then temperature decreases.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred in to the gas during this process

11. Explain: *temp increase so heat ransferred to gas.*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*No gas escapes*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred into the gas during this process

7. Explain: *It is pumped in*

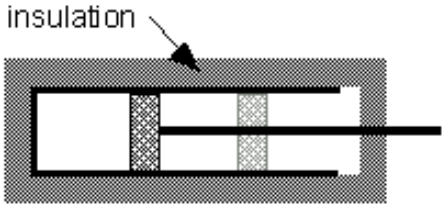
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will decrease*

9. Explain: *It is in water*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred in to the gas during this process

11. Explain: *Out of container*



A sealed cylindrical pump contains one mole of an ideal gas. The piston fits tightly so that no gas escapes, but friction is negligible between the piston and the cylinder walls.

The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will remain the same*
5. Explain:*The temperature of the gas will remain the same becuase it is an insulated system and therefore the temperature cannot change*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *There is no heat transfer occuring during this process because teh temperature is not changing since it is an insulated system*.

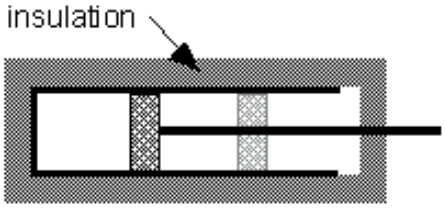
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will decrease*

9. Explain: *The temperature of the gas will decrease because there is more pressure exerted on the gas but there is less volume inside the container and therefore the outside temperature affects what is in the container*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *Heat is transferred out of the gas during this process because the outside temperature is affecting what is inside the container and therefor the temperature of the gas is decreasing*.



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will decrease*
5. Explain:*temp and volume are directly proportional*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *it is insulated*

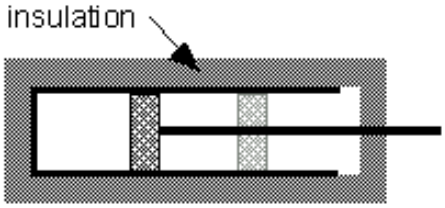
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *not enough information is given to determine the change in temperature*

9. Explain: *you do not what tempature the gas starts at for the heat transfer process*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
not enough information is give to determine how heat is transfered

11. Explain: *ditto*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will decrease*
5. Explain:*P V direct*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

7. Explain: *i dont know*

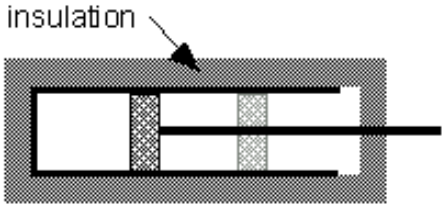
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will decrease*

9. Explain: *Not quite sure*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred in to the gas during this process

11. Explain: *not sure which direction*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*The decrease in volume will cause an increase in pressure, which is the number of gas molecules hitting the wall of the cylinder at a time, this will increase the overall speed and number of collisions, which will cause an increase in energy for the system.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

7. Explain: *Increase in energy for the system happens for to the gas, which i transfered to the pump. If you could touch the pump it would be hot, which means that it is transfering heat to your hand. if it was cold it would be taking heat from your hand, and by extension so would the gas.*

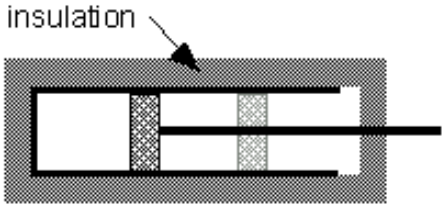
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *the gas which was at equilibrium at 0 deg C will increase because the pressure in the piston has increased, by the same reasoning as before. the gas molecules will be moving slower at 0 C than they were in the first experiment, but they will, when compressed enough speed up and increase their temp.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *by the same reasoning as before. the temp of the water around the cylinder will increase slightly*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will remain the same*
5. Explain:*The gas is thermally insulated from its surroundings, so it didn't gain or lose heat. The decrease in volume was compensated for by the increase in pressure.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *The temperature remained the same.*

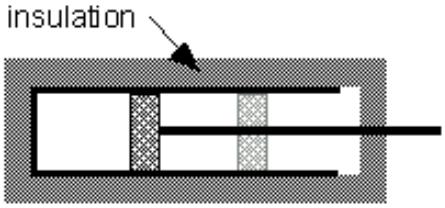
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will decrease*

9. Explain: *The gas is not isolated from environmental heat transfer, so the decrease in volume was compensated for by the relese of heat, thus, the decrease of temperature.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *The temperature of the gas decreases.*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*Because of the ideal gas law pressure and temerature have a direct relationship*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *If the system is thermodynamically isolated then there wouldn't be a heat transfer between the system and its surrondings*.

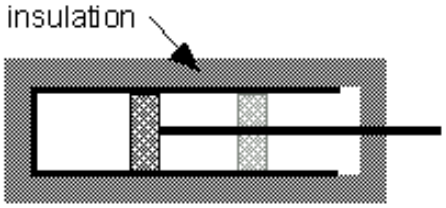
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *same as before ideal gas law*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *The system will increase temperature but then the ice water will then need heat from the gas or "the system" to make the heat of the system in equilibrium*.



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will remain the same*
5. Explain:*there is no change in energy to cause a temperature change*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *its insulated and sealed*.

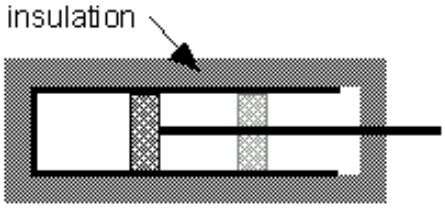
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *its at thermal equilibrium*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *before the gas is at equilibrium with the water, it is hotter than the water and must lose heat energy to decrease in temperature*.



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*As pressure increases, volume decreases and temperature increases.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *The change in temperature is totally internal; no outside heat source causes it*

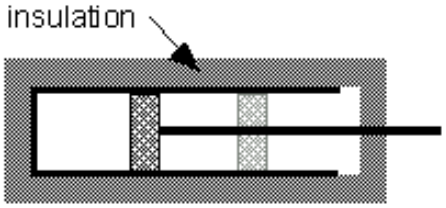
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *the surroundings will cause the gas inside the piston to remain at the same temperature as the ice water ; 0 degrees C*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *the gas would normally gain heat during the compression, but the heat is transferred out by the ice water*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*The temperature will increase because the pressure is increased and when enrgey is added to the system the temperature must increase*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred into the gas during this process

7. Explain: *The energy from the piston creates heat which is transfered to the gas*

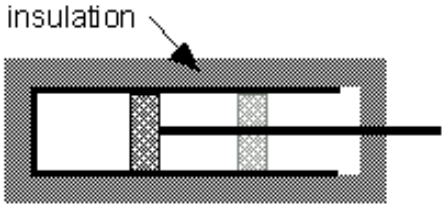
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *You add energy so the gas molecules move faster creating heat*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *The gas is heated then the heat is lost becasue it isn't insulated.*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*Work is being done on the gas*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *The cylinder is isolated from its surrounds by an insulator*.

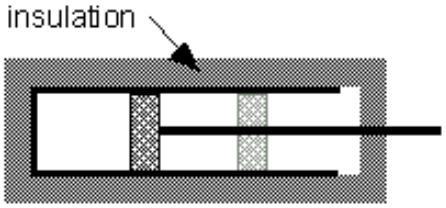
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *The temperature of the gas will increase like in situation 1. Since the gas and the water are at thermal equilibrium, their temperatures will both slowly increase as the system maintains thermal equilibrium*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *Heat flows from higher temperatures to cooler temperatures*.



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*energy is added and the atoms will excite and bounce off each other more*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *thermally isolated*

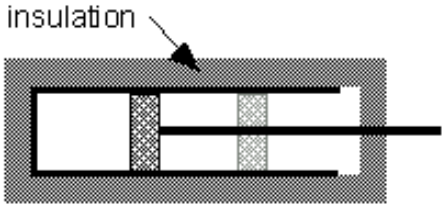
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *heat transfer will keep it the same*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *the system wants to be in a state of equilibrium, so heat will flow from warm to cold*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*pressure increases*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred into the gas during this process

7. Explain: *increased pressure causes heat*

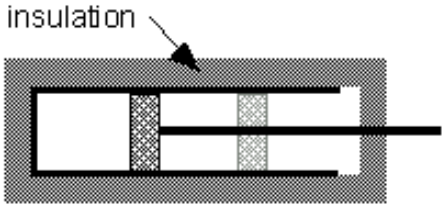
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *increase in pressure*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred in to the gas during this process

11. Explain: *increase in preassure*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*If pressure increases the temperature must increase*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred into the gas during this process

7. Explain: *Heat is transferred into the gas as a result of the added pressure*.

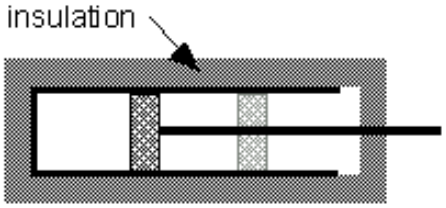
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *not enough information is given to determine the change in temperature*

9. Explain: *The water will cause the gas to cool but the increase in pressure will warm the gas*.

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
not enough information is give to determine how heat is transfered

11. Explain: *Same as above*.



A sealed cylindrical pump contains one mole of an ideal gas. The piston fits tightly so that no gas escapes, but friction is negligible between the piston and the cylinder walls.

The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*because the pressuare of the system incresed so the molecules will move more quickly cusing the temperature to rise*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred into the gas during this process

7. Explain: *because work is being done on the gas*

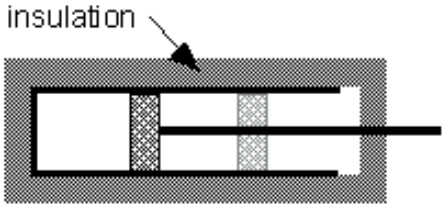
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *only slightly because under pressure the gas has to be closer together causing it to bump into the other molecules*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer occurs during this process

11. Explain: *just a change in pressure*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will remain the same*
5. Explain:*T=PV/nR. When, V decreases, P increases, and T is constant.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *It is insulated by an ideal insulator, and there is no change in T, so there is no heat transfer.*

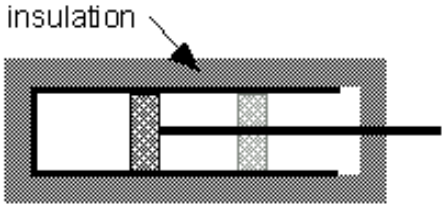
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *T=PV/nR. When, V decreases, P increases, so T is constant.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer occurs during this process

11. Explain: *The system is in thermal equilibrium, so there is no heat transfer.*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*Since work is done on the gas and the volume and pressure are increased the temperature will be as well.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *Since the gas is not allowed to get out of the piston it is not allowed to change form.*

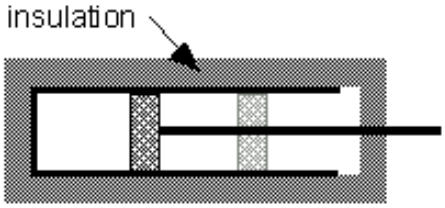
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *since the volume and pressure are increased, the temperature must increase as well.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *Since it is now in water and is warming up and is not insulated, and the temperature of the gas increases, it will transfer to the colder water to warm it up as well*



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4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred into the gas during this process

7. Explain:

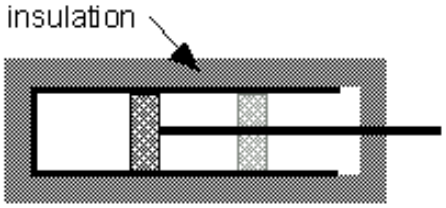
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain:

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred in to the gas during this process

11. Explain:



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will remain the same*
5. Explain:*as the volume decreases the pressure increases so the temp would stay the same*.

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

7. Explain: *as it compresses it would lose heat from the gas*

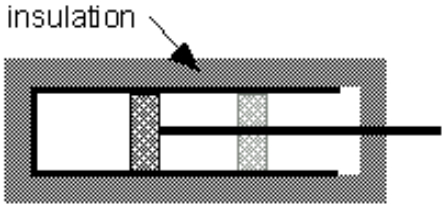
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will remain the same*

9. Explain: *as the temp from the water is cooling the piston the gas is being compressed and giving off heat so it would remain the same*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *the compressed gas would be giving off heat the more it gets compressed*.



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*some crazy chemistry shit happens and the temperature increases, yeah boy*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred into the gas during this process

7. Explain: *clearly the heat had to come from somewhere*

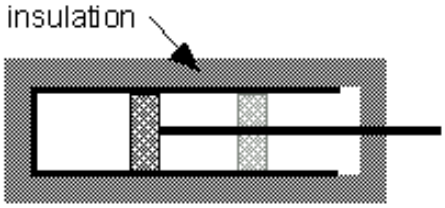
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *as the hard rod pistons into the cold box, an explosion of heat spews forth from the head of the shaft, thus heating the gas*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred in to the gas during this process

11. Explain: *the heat had to come from somewhere*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*As the pressure increases the Temperature will increase*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

7. Explain: *As the pressure increases the temperature will increase which means that there is a transfer of heat within the system coming from out of the gas.*

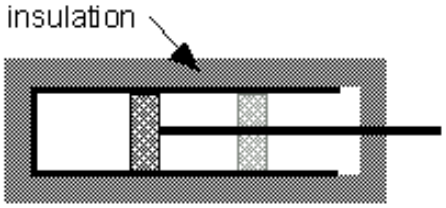
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *The temperature of the gas will increase because the pressure is increasing.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *The heat is being transfered out of the gas into the piston however because there is no insulation the heat is then being transfered to the ece water mixture.*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will remain the same*
5. Explain:*The temperature will remain the same becasue the pressure increases and the volume decreases. And PV=NkT and Nk are constant.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
no heat transfer is occuring during this process

7. Explain: *No heat transfer because there is no external heat source.*

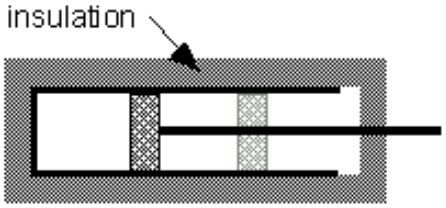
The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *Increase because there is the external pressure of the water and the pressure of the piston. Therefor the temperature must increase.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *The gas is in ice cold water, therefore if its temperature increases it is going to want to go back to its equilibrium condition of being the same temperature as its surrounding environment.*



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The pump is thermally insulated from its surroundings. The piston is quickly pressed inward as indicated in the diagram.

4. The temperature of the gas: *the temperature of the gas will increase*
5. Explain:*More pressure. the gas molecules will be hiting the wall and oneanother faster, making the overall temperature increase.*

6. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

7. Explain: *The heat is radiating off the gas molecules from their increased energy, so it is coming from the gas during this process.*

The pump is returned to its original state and then (without the insulation) placed in a very large container that is filled with an ice-water mixture. The system is allowed to come to thermal equilibrium at 0O C. The piston is then pressed inward very slowly.

8. The temperature of the gas: *the temperature of the gas will increase*

9. Explain: *Same as question number 1.*

10. Is there any heat transfer occurring during this process? If so, identify the direction of the transfer.
heat is transferred out of the gas during this process

11. Explain: *Heat goes to cold, cold does not go to heat, so the heat is still transfering out of somewhere - the gas - and to the surroundings.*