Welcome! to Phys 2210

1) Press & HOLD power ➔ blue *flash.*
2) Key in DC ➔ green *flash*

Do you have a clicker with you today?

A) Yes, I have a clicker with me.
B) No, I don't have a clicker so I can't vote.

1

In Classical Mechanics, can this equation be derived?

$$\vec{F}_{net} = \frac{d\vec{p}}{dt}$$

A) Yes
B) No

5

In Classical Mechanics,
can this equation be derived?

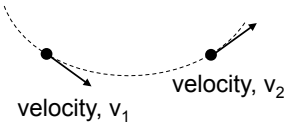
$$\vec{\tau}_{net} = \frac{d\vec{L}}{dt}$$

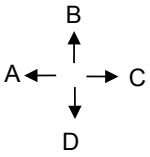
A) Yes

B) No

6

An object has velocity $\mathbf{v_1}$ at an earlier time, and $\mathbf{v_2}$ later, as shown. What is the direction of $\Delta\mathbf{v} = \mathbf{v_2} - \mathbf{v_1}$?

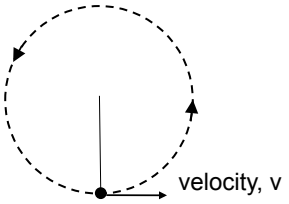


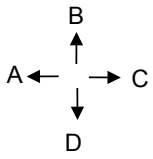


E) Other/???

7

A rock is twirled in a circle with constant speed by an astronaut in intergalactic space. At the moment shown, what is the direction of the acceleration of the rock?

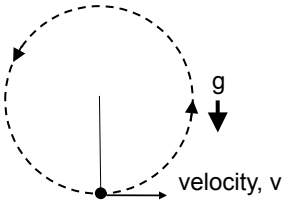


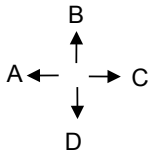


E) Other/???

9

A rock is twirled in a vertical circle near the surface of earth with constant speed. At the moment shown, what is the direction of the acceleration of the rock?





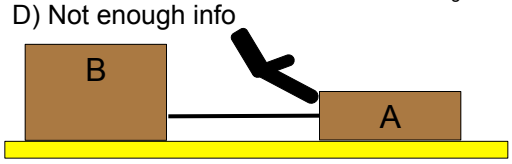
E) Other/???

10

Blocks A and B are on a frictionless table, connected by a massless string.
Your hand pushes on the back of block A.
Compare the force of your *hand* on A to the force of the *string* on B :

$|F|_{\text{hand on A}}$ is A)> B)< C) = $|F|_{\text{string on B}}$

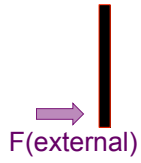
D) Not enough info



11

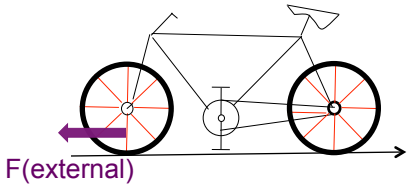
If you push hoizontally on the *bottom* end of a long, rigid rod of mass m (floating in space), what does the rod do?

A) Rotates in place, but the CM doesn't move
B) Accelerates to the right, with $a_{CM}<F/m$
C) Accelerates to the right, with $a_{CM}=F/m$
D) Other/not sure/depends...



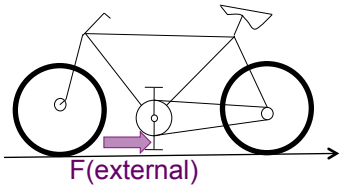
12

If you push forwards on a lower spoke as shown, the bike moves
A) Left B) right C) no motion D) ??



13

If you push backwards on the *bottom* pedal of a fixed-gear bike as shown, the bike moves
A) Left B) right C) no motion D) ??



14

Which of these integrals can be solved using “integration by parts”?

i) $\int dx \frac{\ln x}{x^2}$ ii) $\int dx\, e^{x^2}$

iii) $\int dx\, x^2 e^{2x}$

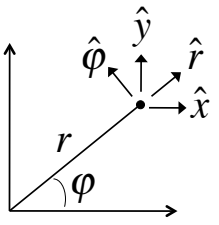
A) none B) i & ii C) ii & iii
D) i & iii E) all of them

15

A ball is moving around in a plane. Which of the following unit vectors might vary with time?

I: $\hat{x}$ II: $\hat{\varphi}$ III: $\hat{r}$

A) All
B) none
C) II only
D) III only
E) II and III



16

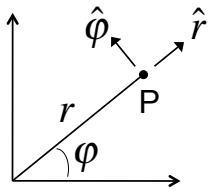
Which gives the position vector "**r**" of the point P at (x,y)=(1,1)?

A) $\vec{\mathbf{r}} = \sqrt{2}\,\hat{r}$

B) $\vec{\mathbf{r}} = \sqrt{2}\,\hat{r} + \frac{\pi}{4}\hat{\phi}$

C) $\vec{\mathbf{r}} = \sqrt{2}\,\hat{r} - \frac{\pi}{4}\hat{\phi}$

D) $\vec{\mathbf{r}} = \frac{\pi}{4}\hat{\phi}$ E) Other



17

$$\hat{\mathbf{r}} = \cos\phi\,\hat{\mathbf{x}} + \sin\phi\,\hat{\mathbf{y}}$$

What is $\hat{\phi}$?

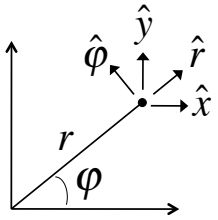
A) $\hat{\phi} = -\cos\phi\,\hat{\mathbf{x}} + \sin\phi\,\hat{\mathbf{y}}$

B) $\hat{\phi} = \sin\phi\,\hat{\mathbf{x}} + \cos\phi\,\hat{\mathbf{y}}$

C) $\hat{\phi} = -\sin\phi\,\hat{\mathbf{x}} + \cos\phi\,\hat{\mathbf{y}}$

D) $\hat{\phi} = -\sin\phi\,\hat{\mathbf{x}} - \cos\phi\,\hat{\mathbf{y}}$

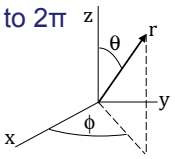
E) Other!



18

In spherical coordinates, to integrate over a sphere (radius R, centered at origin) what are the correct limits of integration?

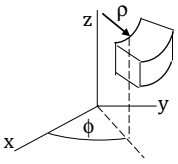
A) r: 0 to R, θ: 0 to π, φ: 0 to 2π
B) r: 0 to R, θ: 0 to 2π, φ: 0 to 2π
C) r:-R to R, θ: 0 to 2π, φ: 0 to π
D) r: -R to R, θ: 0 to 2π, φ: 0 to 2π
E) None of these!



19

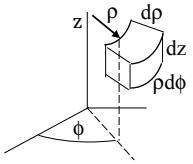
In cylindrical coordinates, what is the correct volume element, dV = ?

A) dρ dΦ dz
B) ρ dρ dΦ dz
C) ρ^2 dρ dΦ dz
D) sinΦ dρ dΦ dz
E) ρ sinΦ dρ dΦ dz



20

In cylindrical coordinates, what is the correct volume element, dV = ?



A) dρ dΦ dz
B) ρ dρ dΦ dz
C) ρ^2 dρ dΦ dz
D) sinΦ dρ dΦ dz
E) ρ sinΦ dρ dΦ dz

21

The position of a moving particle is given by $\mathbf{r}(t) = b\cos\omega t\hat{\mathbf{x}} + c\sin\omega t\hat{\mathbf{y}}$

Describe this orbit:

A) circular, uniform motion
B) circular, non-uniform motion
C) helical
D) elliptical
E) Other!!

22

In Phys 1110, centripetal acceleration was usually written $a = v^2/R$, or else (in terms of angular speed $\omega = v/R$) $a = \omega^2 R$.

$$F_r = \overset{A}{m\ddot{r}} - \overset{B}{mr\dot{\varphi}^2}$$

$$F_\varphi = \overset{C}{m\ddot{\varphi}} - \overset{D}{2m\dot{r}\dot{\varphi}}$$

Which term is "centripetal force"?

23

In Phys 1110, centripetal acceleration was usually written $a = v^2/R$, or else (in terms of angular speed $\omega = v/R$) $a = \omega^2 R$.

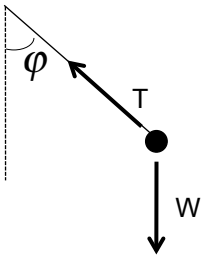
$$F_r = \overset{A}{m\ddot{r}} - \overset{B}{mr\dot{\varphi}^2}$$

$$F_\varphi = \overset{C}{m\ddot{\varphi}} - \overset{D}{2m\dot{r}\dot{\varphi}}$$

Which term is "α, angular acceleration"?

24

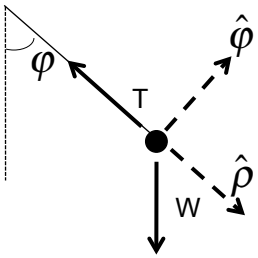
What is T_φ?



A) T
B) Tcosφ
C) Tsinφ
D) 0
E) Something else (signs!)

25

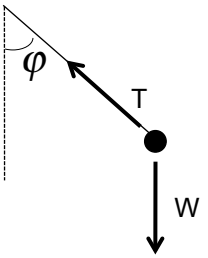
What is T_φ?



A) T
B) Tcosφ
C) Tsinφ
D) 0
E) Something else (signs!)

26

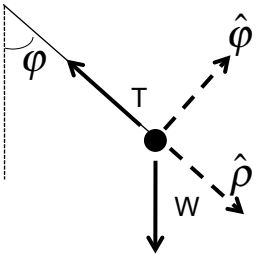
What is W_φ?



A) mg
B) mg cosφ
C) mg sinφ
D) 0
E) Something else (signs!)

27

What is W_φ?



A) mg
B) mg cosφ
C) mg sinφ
D) 0
E) Something else (signs!)

28

For a pendulum, we found

$$mR\ddot{\varphi} = -(mg)\sin\varphi$$

For small angle oscillations, which is the best statement about the period, T?

A) Larger mass means smaller T
B) Longer pendulum means longer T
C) Smaller starting angle means smaller T
D) On Jupiter, the period would be larger
E) None of these, or *more than one*, is correct

29