## AIEEE - 2004 Analysis
## Physics

1. Which one of the following represents the correct dimensions of the coefficient of viscosity?

a) $ML^{-1}T^{-2}$

b) $MLT^{-1}$

c) $ML^{-1}T^{-1}$

d) $ML^{-2}T^{-2}$

➢ c

$F = \eta \ A = \frac{dv}{dx}$

$F \rightarrow \overset{|}{M}\overset{|}{L}T^{-2}$

$A - L^2$

$dV - LT^{-1}$

$dx - L$

2. A particle moves in a straight line with retardation proportinal to its displacement. Its loss of kinetic energy for any displacement x is proportional to

a) $X^2$

b) $e^x$

c) x

d) $\log_{e^x}$

➢ a

$a \ \alpha - x$

$a = -kx$

$V = \frac{dv}{dr} = -kx$ intergraty both sides

$\frac{1}{2}m\int_x^v V\frac{dv}{dr} = \frac{1}{2}km\int_0^x x - dx$ ; $\frac{1}{2}m\left[V^2 - x^2\right] = \frac{km}{2}\int\frac{x^2}{2} \Delta KE \alpha x^2$

3. A ball is released from the top of a tower of height h meters. It takes T seconds to reach the ground.

What is the position of the ball at $\frac{T}{3}$ second ?

a) $\frac{h}{9}$ meters from the ground

b) $\frac{7h}{9}$ meters from the ground

c) $\frac{8h}{9}$ meters from th ground

d) $\frac{17h}{18}$ meters from the ground

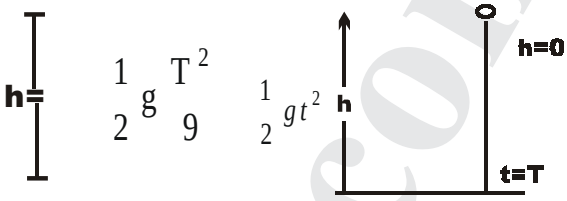
➢ c

The highy from ground
= h - h

$= \frac{gT^2}{2} - \frac{gT^2}{18}$

$= \frac{gT^2[18-2]}{18}$

$= \frac{8}{9}gT^2 = \frac{8}{9}h$




4. If $\vec{A}\times\vec{B} = \vec{B}\times\vec{A}$, then the angle between A and B is

a) $\pi$

b) $\pi/3$

c) $\pi/2$

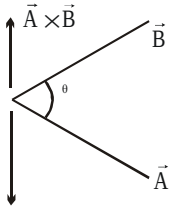
d) $\pi/4$

➢ a

$\vec{A}\times\vec{B} = \vec{B}\times\vec{A} = -\vec{A}\times\vec{B}$

$\therefore$ = $\vec{A}, \vec{B}$ are antiparalled to opposite

$\therefore$ $\vec{A}, \vec{B}$ are $\pi$ angle apard




5. A projectile can have the same range 'R' for two angles of projection If '$T_1$' and '$T_2$' be the time of flights in the two cases, then the product of the two time lf flights is derectly proportional to

a) $\frac{1}{R^2}$

b) $\frac{1}{R}$

c) R

d) $R^2$

➢ c.

$T_1 = \frac{2u\,Sin\,\theta}{g}; T_2 = \frac{2u\,\sin\theta(90-\theta)}{g}$

$T_1 \times T_2 = \frac{2\times 2u^2 Sin\theta\,Cos\theta}{g^2}$

$= \frac{2}{g}\times\frac{2u\,Sin\,\theta.u\cos\theta}{g}$

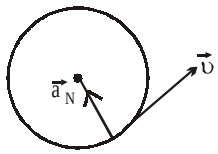
But range = R = $\frac{2u\sin\theta - u\cos\theta}{g}$

$\therefore T_1T_2 = \frac{2R}{g} \Rightarrow T_1T_2 \alpha R$

6. Which of the following statements is **FALSE** for a particle moving in a circle with a constangular speed?
a) The velocity vector is tangent to the circle
b) The acceleration vector is tangent ot the circle
c) The acceleration vector points to the centre of the circle
d) The velocity and acceleration vectors are perpendicular to each other

➢ b

When the particle moves with constant angular speed, it will have only centripetal acceleraties dinated two ands the centre. But the auleration vector can never be tangentical if the circular motion is uniform.




7. An automobile travelling with a speed of 60 km/h, can brake to stop within a distance of 20 m. If the car is going twice as fast i.e., 120 km/h, the stopping distance will be
a) 20 m
b) 40 m
c) 60 m
d) 80 m

➢ d

let $\alpha \quad \Delta v^2 \alpha X$

$x = \alpha(2V)^2 \Rightarrow x$ becomes 4 lines

i.e. $20 \times 4 = 80m$

8. A machine gun fires a bullet of mass 40 g with a velocity 1200 $ms^{-1}$. The man holding it can exet a maximum force of 144 N on the gun.How many bullets can he fire per second at the most?
a) One
b) Four
c) Two
d) Three

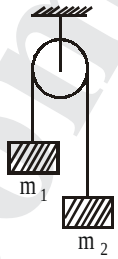
➢ d.

$F = n.\frac{d}{dt}(p)$

$144 = n \times 40 \times 10^{-3} \times 1200$

$n = \frac{144}{48} = 3$

9. Two masses $m_1$ = 5 kg and $m_2$ = 4.8 kg tied to string are hanging over a light frictionless pulley. What is the acceleration of the masses when left free to move ? ( g = 9.8 m/s$^2$)

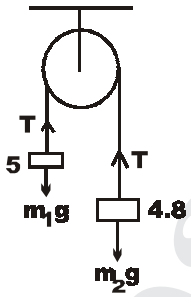



a) 0.2 m/ s$^2$
b) 9.8 m/s$^2$
c) 5 m /s$^2$
d) 4.8 m/s$^2$

➢ a

for $\frac{m_1}{m_1 g - T} = m_1 a$

for $\frac{m_2}{T - m_2 g} = m_2 a$




$g(m_1 - m_2) = a(m_1 + m_2)$

$a = g\frac{(m_1 - m_2)}{m_1 + m_2}$

$= \frac{9.8(5-4.8)}{5+4.8} = 0.2\frac{m}{S^2}$

10. A uniform chain of length 2 m is kept on a table such that a length of 60 cm hangs freely from the edge of the table. The total mass of the chain is 4 kg. What is the work done in pulling the entire chain on the table ?

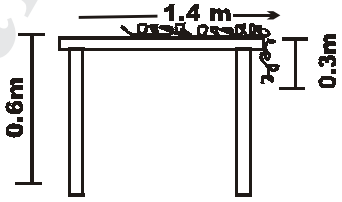
a) 7.2 J
b) 3.6 J
c) 120 J
d) 1200 J

➢ b

lot g having
part = linear dairty $\times$ 0.6

$\frac{4kg}{2m} \times 0.6 \times 10$

change in P.E = work done




$= \frac{4}{2} \times 0.6 \times 10 \times 0.3$

$= 3.6$ J

11. A block rests on a rough inclined plane making an angle of 30$^0$ with the horizontal. The coefficient of static frection between the block and the plane is 0.8 if the fricitional force on the block is 10 N. the mass of the block (in Kg) is ( Take g = 10 cm/s$^2$)

a) 2.0
b) 4.0
c) 1.6
d) 2.5

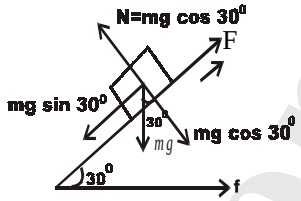
➢ a

F = fictional force

F = mg sin $30^0$

$10 = m \times 10 \times \frac{1}{2}$

m = 2




12. A force $\vec{F} = \left(5\vec{i} + 3\vec{j} + 2\vec{k}\right)$ N is applied over a particle which displaces it from its origin to the point $\vec{r} + \left(2\vec{i} - \vec{j}\right)$ m. The work done on the particle in joules is

a) -7
b) +7
c) +10
d) +13

➢ b

$w = \vec{F}, \vec{\pi} = (5\vec{i} + 3\vec{j} + 2\vec{k}).(2\vec{i} - \vec{j})$

$= 5 \times 2 + 3(-1)$

= 10 - 3

= 7 joule

13. A body of mass 'm' accelerates uniformly from rest to '$v_1$' in time '$t_1$' The instantaneous power delivered to the body as a function of time 't' is

a) $\frac{mv_1 t}{t_1}$

b) $\frac{mv_1^2 t}{t_1^2}$

c) $\frac{mv_1 t^2}{t_1}$

d) $\frac{mv_1^2 t^2}{t_1}$

➢ b

$\upsilon_1 = u + at_1$ ; $a = \frac{V_1}{t_1}$

Instantauoues power = dp = F. dv

$m \times \frac{v_1}{t_1}.dv$ dv = at

Instantauoues power as a function of f is

$= \frac{mv_1}{t_1}.at = \frac{mv_1}{t_1} \times \frac{v_1}{t_1}.t$

$= \frac{mv_1^2}{t_1^2} \times t$

14. A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle. the motion of the particle takes place in a plane. It follows that
a) its velocity is constant
b) its acceleration is constant
c) its kinetic energy is constant
d) is moves in a straight line

➢ c

It takes a circular path with magnitude of velocity remaing constant
∴ let remain constant as it is a scalar quantity

15. A solid sphere is rotating in free space. If the radius of the sphere is increased keeping mass same which one of the following will not be affected ?
a) Moment of inertia
b) Angular momentum
c) Angular velocity
d) Rotational kinetic energy

➢ c

Moment of intertia angular and Rotational KE, all depend on radius ecept Angular velocity