UNIT TEST-03

Subject : Physics

Class : XI

Q.1 (2)	**Q.2** (4)	**Q.3** (3)	**Q.4** (1)	**Q.5** (2)	**Q.6** (1)	**Q.7** (1)	**Q.8** (4)	**Q.9** (1)	**Q.10** (4)
Q.11 (3)	**Q.12** (4)	**Q.13** (2)	**Q.14** (3)	**Q.15** (2)	**Q.16** (4)	**Q.17** (3)	**Q.18** (3)	**Q.19** (4)	**Q.20** (2)
Q.21 (4)	**Q.22** (1)	**Q.23** (3)	**Q.24** (1)	**Q.25** (4)	**Q.26** (2)	**Q.27** (3)	**Q.28** (3)	**Q.29** (2)	**Q.30** (4)
Q.31 (3)	**Q.32** (1)	**Q.33** (1)	**Q.34** (1)	**Q.35** (2)	**Q.36** (1)	**Q.37** (4)	**Q.38** (4)	**Q.39** (3)	**Q.40** (2)
Q.41 (3)	**Q.42** (4)	**Q.43** (1)	**Q.44** (4)	**Q.45** (3)	**Q.46** (1)	**Q.47** (4)	**Q.48** (1)	**Q.49** (1)	**Q.50** (2)

Q.1 (2)

Q.2 (4)

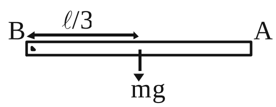
Q.3 (3)

Q.4 (1)

About point B,

$\tau = I\alpha$

$$mg\frac{\ell}{2} = \frac{m\ell^2}{3}\times\alpha$$



$$\alpha = \frac{3g}{2\ell}$$

Now, $a_{CM} = r\alpha$

$$= \frac{\ell}{2}\times\frac{3g}{2\ell}$$

$$a_{cm} = \frac{3g}{4}$$

Q.5 (2)

$m_1v_1 + m_2v_2 = (m_1 + m_2)\,v$

$2 \times 25 + 2 \times (-5) = (2 + 2)\,v$

$50 - 10 = 4v$

$v = 10\,m/s$

Q.6 (1)

Area under the F - t curve and time axis gives the change in momentum.

Area = $(-4 + 4 - 1 + 1) = 0$

Q.7 (1)

Force = rate of change of momentum

$$\frac{\Delta p}{t} = \frac{25}{0.05} = 500\,N$$

Q.8 (4)

Initial momentum of the bullet

$p_1 = n\,m\,v = 200 \times 0.03 \times 50$

$= 300$ kg ms^{-1}

Final momentum

$p_2 = -nmv = -200 \times 0.03 \times 30$

$= -180$ kg ms^{-1}

Force acting $= p_2 - p_1 = -180 - (300)$

$= -480\,N = 480\,N$

Q.9 (1)

Q.10 (4)

$50 \times 10 = 1000 \times v$

$$\therefore\ v = \frac{1}{2}\,m/s$$

$$E_i = \frac{1}{2}\times\frac{50}{1000}\times 10\times 10 = 2.5\,j$$

$$E_f = \frac{1}{2}\times\frac{1000}{1000}\times\frac{1}{2}\times\frac{1}{2} = \frac{1}{8}\,j$$

$$\%\ \text{loss} = \frac{2.5 - 1/8}{2.5}\times 100 = 95\%$$

Q.11 (3)

Given, $n = 1200$ rev / min

$$= \frac{1200}{60}\ \text{rev/s}$$

= 20 rev/s

$\omega = 2\,\pi\,n = 2\,\pi(20) = 40\,\pi$ rads^{-1}

Angular acceleration, a = 4 rads^{-2}

From equation of rotational motion

$$\omega^2 = \omega_0^2 - 2a\theta = 0,\ \omega$$

$$\therefore\ \theta = \frac{\omega_0^2}{2a} = \frac{(40\pi)^2}{2\times 4} = 200\pi^2$$

$$\therefore\ \text{Number of revolutions} = \frac{200\,\pi^2}{2\pi}$$

$= 100\,\pi$

$= 100 \times 3.14$

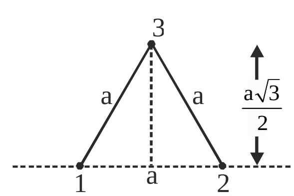
$= 314$

Q.12 (4)

Q.13 (2)

From $v = r\omega$, linear velocities (v) for particles at different distances (r) from the axis of rotation are different.

Q.14 (3)



Movement of inertia of mass (1) and (2)

$$I = M\left(\frac{\sqrt{3}a}{2}\right)^2 = \frac{3ma^2}{4}$$

Q.15 (2)

Q.16 (4)

Angular acceleration is

$$\alpha = \frac{\tau}{I} = \frac{\tau}{MK^2} = \frac{10^5}{10 \times 50^2} = 4\ \frac{rad}{s^2}$$

Q.17 (3)

$P = \tau\omega$

$10 \times 10^3 = \tau 2\pi f$

$$100 \times 10^3 = \tau \times 2\pi\left(\frac{1800}{60}\right)$$

$$\tau = \frac{100 \times 10^3 \times 60}{1800 \times 2\pi} = 530.51\ \text{N-m}$$

Q.18 (3)

Rotation kinetic energy

$$= \frac{1}{2}\ I\omega^2 = \frac{1}{2}\ (2mr^2)\ (2\pi n)^2\ = 4\pi^2 mr^2 n^2$$

Q.19 (4)

Q.20 (2)

$I_1\omega_1 = I_2\omega_2$

$M R_1^2\, \omega_1 = M R_2^2\, \omega_2$

$$\frac{R_1}{R_2} = \sqrt{\frac{\omega_2}{\omega_1}} = \frac{3}{1}$$

Q.21 (4)

Q.22 (1)

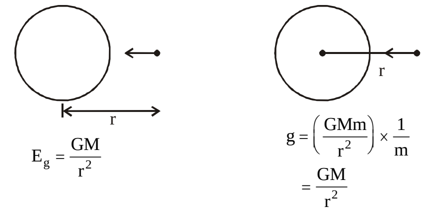
$$g = \frac{GM}{R^2}$$

$$M = \frac{gR^2}{G}$$

Q.23 (3)

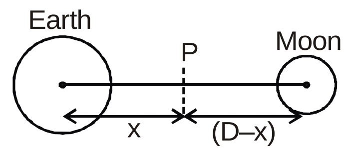
Force of gravity or gravitation does not depend on surrounding medium.

Q.24 (1)



So value of E_g and g is same

Q.25 (4)



At point 'p' for gravitation field to be zero field due to earth= field due to moon

$$\Rightarrow \frac{GM_e}{x^2} = \frac{GM_m}{(D-x)^2} \Rightarrow \frac{81M_m}{x^2} = \frac{M_m}{(D-x)^2}$$

$$\Rightarrow \frac{x}{D-x} = 9 \Rightarrow 9(D-x) = x \Rightarrow x = \frac{9D}{10}$$

Q.26 (2)

$$g_A = \frac{GM}{(R + R/2)^2} = \frac{4GM}{9R^2} = \frac{4}{9}g$$

$$g_B = g\left[1 - \frac{d}{R}\right] \text{ here } d = \frac{R}{2}; g_B = \frac{g}{2} \qquad \therefore \frac{g_n}{g_a} = \frac{9}{8}$$

Q.27 (3)

$g' = g - \omega^2 R \cos^2\lambda$

$\lambda = 60^o$, $g' = 0$

$0 = g - \omega^2 R \cos^2 60$

$$g = \frac{\omega^2 R}{4} \Rightarrow \omega^2 = \frac{4g}{R}$$

$$\omega = \sqrt{\frac{4g}{R}} \Rightarrow \frac{2\pi}{T} = \sqrt{\frac{4g}{R}}$$

$$T = 2\pi\sqrt{\frac{R}{4g}} = \pi\sqrt{R/g}$$

Q.28 (3)

Q.29 (2)

$$g_{eff} = g\left(1 - \frac{2h}{R}\right) = g\left(1 - \frac{32 \times 2}{6400}\right) = g(1 - 0.01)$$

$g_{eff} = 0.99\ g\ ms^{-2}$

Q.30 (4)

$$v_e = \sqrt{\frac{2GM}{R}} \quad \therefore\ v_e \propto \sqrt{\frac{M}{R}}$$

$$\Rightarrow \frac{(v_e)_2}{(v_e)_1} = \sqrt{\frac{M_2}{M_1} \times \frac{R_1}{R_2}} = \sqrt{4 \times \frac{1}{2}} = \sqrt{2}$$

$$\therefore\ (v_e)_2 = \sqrt{2}\,(v_e)_1 = 1.4\ v_e$$

Q.31 (3)

work done = change in Gravitational potential Energy

$W = U_F - U_I$

$$= 3\left(\frac{-Gm^2}{2r}\right) - \left(\frac{-3Gm^2}{r}\right)$$

$$= \frac{3}{2}\ \frac{Gm^2}{r}$$

Q.32 (1)

Gravitational P.E of a body

$$= \frac{-GMm}{r}$$

P.E at r = 2R, $E_1 = \frac{-GMm}{2R}$

P.E at r = 3R, $E_2 = \frac{-GMm}{3R}$

$\Delta E = E_2 - E_1$

$$= \frac{-GMm}{3R} + \frac{GMm}{2R}$$

$$= \Delta E = +\frac{GMm}{6R}$$

Q.33 (1)

Q.34 (1)

$$T = \frac{2\pi r}{v} = \frac{2\pi r}{\sqrt{\frac{GM}{r}}} = \frac{2\pi r^{3/2}}{\sqrt{GM}}$$

Hence $T^2 = \frac{4\pi^2 r^3}{GM}$

$$T^2 = \left(\frac{4\pi^2}{GM}\right) r^3$$

Hence slope of T^2 Vs r^3 curve is = $\frac{4\pi^2}{GM}$

Q.35 (2)

Mass of planet, $M = 2\ M_e$

Radius of planet, $R = 2\ R_e$

Escape velocity from earth

$$u = \sqrt{\frac{2GM_e}{R_e}}$$

Escape velocity from the planet

$$v = \sqrt{\frac{2GM}{R}} = \sqrt{\frac{2G(2M_e)}{2R_e}}$$

$$= \sqrt{\frac{2GM_e}{R_e}} = u$$

Q.36 (1)

COM of semicircular plate is $\frac{4R}{3\pi}$.

Q.37 (4)

Initially, velocity of A and B = 0

$$\Rightarrow \vec{v}_{cm} = \frac{m_1\vec{v}_1 + m_2\vec{v}_2}{m_1 + m_2} = \frac{0+0}{m_1+m_2} = 0$$

Later, both move due to interial pres and internal pres does not affect center of mass

$$\Rightarrow \vec{v}_{cm} = 0 = \text{constant}$$

Q.38 (4)

After striking at the floor the ball cannot return with double the velocity because there will be some loss of KE of the ball after the collision which will appear in the form of sound energy, heat energy, etc.

Q.39 (3)

$$\Delta K.E. = \frac{1}{2}\frac{m_1 m_2}{(m_1+m_2)}(u_1 - u_2)^2$$

$$= \frac{1}{2} \times \frac{40 \times 60}{(40+60)}(4-2)^2$$

$\Delta K.E. = 48\ J$

Q.40 (2)

Mass, m = 10 kg,

Moment of inertia, I = 160 kg-m^2

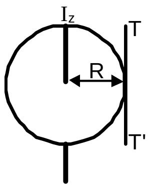
Radius of gyration, $K = \sqrt{\frac{I}{m}} = \sqrt{\frac{160}{10}}$

$$= \sqrt{16} = 4m$$

Q.41 (3)

$I_z = 2I$

where, $I = \frac{MR^2}{4}$



According to theorem of parallel axes, required moment of inertia about axis TT' is

$TT = I_z + MR^2$

$= 2I = Mr^2 + 2I + 4I = 6I$

Q.42 (4)

Q.43 (1)

Q.44 (4)

$$\frac{I_1\omega_1}{I_2\omega_2} = \frac{L_1}{L_2}$$

$\omega_2 = 2\omega_1$

$$\frac{1}{2} I_2\omega_2^2 = \frac{1}{2}\left(\frac{1}{2} I_1\omega_1^2\right)$$

$$\Rightarrow I_2 = \frac{I_1}{8}$$

$$\Rightarrow L_2 = \frac{L_1}{4}$$

Q.45 (3)

Newton's III law of motion.

Q.46 (1)

Beam type balance gives reading by balancing torque which is independent of the value of g.

Spring balance increases weight which is gravitational force.

Q.47 (4)

(a) $G = \frac{Fr^2}{m_1m_2} = \frac{Nm^2}{kg^2} \Rightarrow$ (iii)

(b) $U = -\frac{Gm_1m_2}{r}$ Joule $\Rightarrow$ (i)

(c) Potential $= \frac{W}{m} = \frac{J}{kg} \Rightarrow$ (iv)

(d) $I = \frac{F}{m}$ N/kg or m/s^2 $\Rightarrow$ (ii)

Q.48 (1)

height from centre of earth will

$h_1 = 2R$

$h_2 = 8R$

$$K.E. = -\frac{GMm}{(R+h)}$$

$$\frac{K_1}{K_2} = \frac{8R}{2R} = 4$$

$$T.E. = \frac{GMm}{(R+n)}$$

$$\frac{E_{T_1}}{E_{T_2}} = \frac{4}{1}$$

So option (1) is incorrect

Q.49 (1)

$$V_e = \sqrt{\frac{2GM_E}{R_E}}$$

$$V_e' = \sqrt{\frac{2G(100M_E)}{4R_E}}$$

$$= 5\sqrt{\frac{2GM_E}{R_E}}$$

$= 5\,V_e = 56$ km/s

Q.50 (2)

$$\frac{dA}{dt} = \frac{L}{2m} = \text{Constant}$$