Sample Paper-03

Class 11th NEET (2024)

PHYSICS

ANSWER KEY

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

HINTS AND SOLUTION

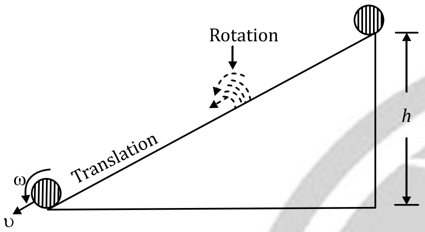
1. (3)

When minimum speed of body is $\sqrt{5gR}$, then no matter from where it enters the loop, it will complete full vertical loop.

2. (3)

$1=\frac{1}{2}MR^2$

From the law of conservation of energy, we have Potential energy = Translational kinetic energy + Rotational kinetic energy.



$\text{Mgh}=\frac{1}{2}Mv^2+\frac{1}{2}I\omega^2$

$\text{Mgh}=\frac{1}{2}MR^2\omega^2+\frac{11}{22}MR^2\omega^2$

$=\frac{3}{4}MR^2\omega^2$

$\omega^2=\frac{4gh}{3R^2}$

$\omega=\frac{2}{R}\sqrt{\frac{gh}{3}}$, which is choice(c).

3. (2)

From conservation of mechanical energy

$\frac{1}{2}m\upsilon^2=\frac{GMm}{R_e}-\frac{GMm}{R}$

where, R = maximum height(distance) from centre of the earth

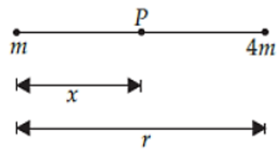
Also $\upsilon=\frac{1}{4}\upsilon_e=\frac{1}{4}\sqrt{\frac{2GM}{R_e}}$

$\Rightarrow\frac{1}{2}m\times\frac{1}{16}\times\frac{2GM}{R_e}-\frac{GMm}{R_e}-\frac{GMm}{R}$

$\Rightarrow R=\frac{16}{15}R_e\Rightarrow h=R-R_e=\frac{R_e}{15}$.

4. (2)

: Let x be the distance of the point P from the mass m where gravitational field is zero.



$\therefore\frac{Gm}{x^2}=\frac{G(4m)}{(r-x)^2}$ or $\left(\frac{x}{r-x}\right)^2=\frac{1}{4}$

or $x=\frac{r}{3}$ ...(i)

Gravitation potential at a point P is

$=\frac{Gm}{x}-\frac{G(4m)}{(r-x)}$

$=-\frac{10}{2}=-5\,\text{ms}^{-2}$

$=-\frac{3Gm}{r}-\frac{3G(4m)}{2r}=-9\frac{Gm}{r}$

5. (1)

$F_{\text{net}}=\sqrt{F^2+F^2+2F^2\cos(240°)}=F$

Magnitude of the resultant will be F.

So, $\frac{xF}{2}=F\Rightarrow x=2$

6. (2)

Maximum stress = Y x(Maximum strain)

$\frac{Mg}{A}=2\times10^{11}\times10^{-3}=2\times10^8\ \text{Nm}^{-2}$

$\Rightarrow$ Maximum mass the wire,

$M=\frac{2\times10^8\times3\times10^8}{10}=60\,\text{kg}$

7. (4)

Let V be the volume of the block. When block floats in water, then

$V\rho_{\text{blockg}}+\left(\frac{4}{5}V\right)\rho_{\text{waterg}}$

Or $V\rho_{\text{block}}=\frac{4}{5}\rho_{\text{water}}$ ...(i)

When block floats in liquid

$V\rho_{\text{block}}=\rho_{\text{liquid}\,g}$

Or $\rho_{\text{block}}=\rho_{\text{liquid}}$

$\therefore\rho_{\text{liquid}}=\frac{4}{5}\rho_{\text{water}}=\frac{4}{5}\times10^3\ \text{kgm}^{-3}$

= 800 kgm^{-3}.

8. **(2)**

Force on one half due to surface tension

$= 2 \times (2\pi r)T = 4\pi rT.$

9. **(3)**

$\Delta L = L\alpha\Delta T$

Slope $\Rightarrow \frac{\Delta L}{\Delta T} = L\alpha$

$(\text{Slope})_A < (\text{Slope})_B, L(A)_{\alpha_A} = L_B\alpha_B$

$\because L_A = L_B$ therefore $\therefore (\alpha_A < \alpha_B)$

10. **(3)**

$Q = 20\text{kg} \times 4200\text{Jkg}^{-1}\text{K}^{-1} \times 25°\text{C}$

$Q = 84000 \times 25$

$Q = 2100000$

$Q = 21 \times 10^5\text{J}$

Q is the heat energy used to rise the temperature of the water.

Since output power = 80% of 1000 W

$P_{\text{output}} = \frac{80}{100} \times 1000$

$P_{\text{output}} = 0.8 \times 1000$ W

Therefore if the time taken is t then:

$21 \times 10_5$ J = 0.8 × 1000 W × t

$t = \frac{21 \times 10^5}{800}$

$t = 0.02625 \times 10^5$

$t = 2625\,\text{sec}$

$t = \frac{2625}{60}\,\text{min}$

$t \approx 44\,\text{min}$

Therefore the required time is 44 min.

11. **(4)**

For adiabatic process, $PV\gamma = K$

$\Rightarrow \ln P = -\gamma \ln V + \ln K$

As slope for $B >$ slope for A, thus $\gamma B > \gamma A$ Hence B is monoatomic and A is diatomic.

12. **(4)**

This S.H.M. can be represented by

$x = a \sin \omega t$

$\Rightarrow a \sin \frac{2\pi t}{T}$

$\Rightarrow x\left(t = \frac{T}{8}\right) = a \sin\left(\frac{2\pi}{T} \times \frac{T}{8}\right) = a \sin\left(\frac{\pi}{4}\right) = \frac{a}{\sqrt{2}}$

13. **(4)**

Both points°B° and °G° are moving up and are at the same distance from equilibrium position at the • instant shown.

Hence, °B° and = °G° are in phase

14. **(1)**

Due to buoyancy, the effective acceleration due to gravity gravity decreases from

g to g' = g – g/8 = 7 g/8.

Since, $T = 2\pi\sqrt{\frac{l}{g}}$. The new time period will be:

$T' = 2\pi\sqrt{\frac{l}{g'}} = 2\pi\sqrt{\frac{l}{7g/8}}$

Thus, $\frac{T'}{T} = \sqrt{\frac{g}{7g/8}} = \frac{8}{7}$

Or $T' = \sqrt{\frac{8}{7}}T$

15. **(3)**

Both the spring are in series

$\therefore K_{eq} = \frac{K(2K)}{K + 2K} = \frac{2K}{3}$

Time period

$T = 2\pi\sqrt{\frac{\mu}{K_{eq}}}$ where $\mu = \frac{m_1 m_2}{m_1 + m_2}$

Here, $\mu = \frac{m}{2}$

$\therefore T = 2\pi\sqrt{\frac{m}{2}.\frac{3}{2K}} = 2\pi\sqrt{\frac{3m}{4K}}$

16. **(3)**

$v_i = +10\,\text{ms}^{-1}$ and $v_f = 0$

$\therefore \Delta v = v_f - v_i = -10\,\text{ms}^{-1}$

$a_{av} = \frac{\Delta v}{\Delta t} = \frac{-10}{6} = \frac{-5}{3}\,\text{ms}^{-2}$

Total displacement = Area under $v - t$ graph (with sign)

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

and acceleration = slope of $v - t$ graph

$= -\frac{10}{2} = -5\,\text{ms}^{-2}$

Hence, $A \rightarrow r$, $B \rightarrow p$, $C \rightarrow r$, $D \rightarrow s$.

17. **(2)**

The amplitude of oscillation of pressure in the medium is maximum where the displacement of the particle of the medium is zero and vice-versa. Hence, the pressure wave and displacement wave are out of phase by $\pi/2$.

18. **(2)**

Now at point *A*, the normal force will just be due to gravity such the surface is flat (which means the radius of curvature is Infinite).

So, N_A = mg

For point *B*, the car will experience gravitational acceleration as well as centripetal force since the road is curved. For point *B*, since the center of curvature lies upwards, the radius of curvature win be considered positive and the normal force on the car will be

$$N_B = \text{mg} + \frac{mv^2}{r}$$

For point *C*. the car will experience gravitational acceleration as well as centripetal force since again, the road is curved. For point *C*. since the centre of curvature lies downwards of the road, the radius of curvature will be

$$N_B = \text{mg} - \frac{mv^2}{r}$$

considered positive and the normal force on the car will be

Hence, we can see that the maximum normal force is for point *B* and hence the apparent weight of the car will be maximum at point *B*.

19. **(3)**

A body having freefall always have a constant acceleration 9.8 meter per second square and the gravitational force depends on the mass of the object so *A* is true and *R* is false.

20. **(1)**

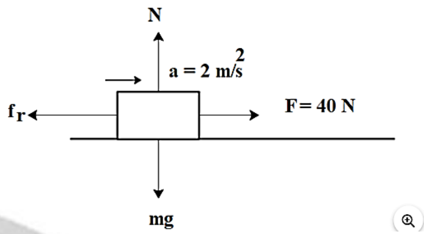
If the direction of river flow and direction of swimming is are perpendicular to each other, the component speed of the swimmer will be maximum and it would be Vsin90∘.

So, both assertion and reason are both correct having correct explanation.

21. **(1)**

This Both Statement are correct. The work done by centripetal force is zero because displacement is always perpendicular to the centripetal force in the circular motion. W = F.ds = 0 (for centripetal force.) This implies that the displacement of the the particle in the direction of the centripetal force is zero.

22. **(1)**



Applying equation of motion, we will get,

$\Rightarrow F - f_r = ma$

$\Rightarrow 40 - \mu mg = ma$

$\Rightarrow 40 - \mu \times 10 \times 9.8 = 10 \times 2$

$\Rightarrow \mu \ \frac{20}{98} = \frac{10}{48} \cong 0.2$

23. **(2)**

The correct relation between Celsius & kelvin temperature is given

by t°C = (t + 273.15)k and the correct

Statement-II: Relation between Celsius and Fahrenheit temperature is

$$\frac{C}{5} = \frac{F-32}{9}$$

24. **(2)**

For example, Work and torque have the same dimensions but we cannot add their magnitude as they are different physical quantity. Hence maybe added is the correct answer.

25. **(1)**

Displacement for the first body $h_1 = \frac{1}{2} g^{3^2}$

Displacement for the second body $h_2 = \frac{1}{2} g^{2^3}$

Their separation = $\frac{1}{2} g(9-4) = 5 \times 5 = 25\,\text{m}$

26. **(3)**

According to question,

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

$= 10^{-2} \times 0.1 \times \frac{5}{5}$

= $= 10^{-3}$ N/m^2

27. **(3)**

$(c)(A)|A+B| = \sqrt{A^2+B^2+2AB\cos\theta}$

Here, $|A| = |B| = x$ and $\theta = 60°$

$(B)|A-B| = \sqrt{A^2+B^2-2AB\cos\theta} = x$

$(C)\,A.B = AB\cos\theta = \frac{x^2}{2}$

$(D)|A\times B| = AB\sin\theta = \frac{\sqrt{3}}{2}x^2$

Hence, $A \rightarrow r, B \rightarrow q, C \rightarrow s, D \rightarrow p$.

28. **(4)**

For automobile, $v^2 = u^2 - 2\,as$

$\therefore u_1^2 - 2as_1 = 0$

$\Rightarrow u_1^2 - 2as_1$

Similarly for car, $u_2^2 = 2as_2$

$\therefore \left(\frac{u_2}{u_1}\right)^2 = \frac{s_2}{s_1} \Rightarrow \left(\frac{120}{60}\right)^2 = \frac{s_2}{20}$

or s_2 = 80 m.

29. **(4)**

Angular momentum per unit mass:

$= \frac{[ML^2T^{-1}]}{[M]} = [L^2T^{-1}]$

So angular momentum per unit mass has different dimension.

30. **(3)**

Normal force = Mg(Perpendicular to surface)

$\therefore$ Resultant force (F) = $\sqrt{(N)^2+f^2}$

$F_{min} = N$ Mg when $f = 0$

$F_{max} = \sqrt{(N)^2+f^2}$ when f = μmg

$= \sqrt{(\text{Mg})^2+(\mu\text{Mg})^2}$

$= \text{Mg}\sqrt{1+\mu^2}$

$\therefore$ Mg $\leq F \leq$ $= \text{Mg}\sqrt{1+\mu^2}$

31. **(1)**

Acceleration due to gravity at a height h above the earth's surface is

gh = g = $\left(1-\frac{2h}{R}\right)$

Acceleration due to gravity at a depth d below the earth's surface is

$gd = g\left(1-\frac{d}{R}\right)$

Now, $\frac{gh}{gd} = \left(\frac{1-\frac{2h}{R}}{1-\frac{d}{R}}\right) = \frac{(R-2h)}{(R-d)}$

As h = 1 km, d = 1 km

$\therefore\ \frac{gh}{gd} = \frac{R-2}{R-1}$

32. **(2)**

KE = $\frac{I\omega^2}{2}$

1500 = $\frac{1.2\times\omega^2}{2} \rightarrow \omega = 50$

$\omega_0 = 0$

$\omega = \omega_0 + at = 25t = 50$

t = 2 sec

33. **(3)**

Applying conservation of momentum

2 × 10 + 3 × 0 =)2 + 3)v

$v = \frac{10\times2}{5} = 4\text{m / sec}$

[36 km/hour = 10 m/sec]

Initial Energy = $\frac{1}{2}\times2\times(10)^2+0 = 100\text{J}$

Final Energy = $\frac{1}{2}\times5\times4\times4 = 40\,\text{J}$

Loss of energy = 100 – 40 = 60 Joule

34. **(2)**

Inner radius of ring = r

Outer radius of ring = R

Strain,

$$\frac{\Delta l}{l}=\left(\frac{2\pi R-2\pi r}{2\pi r}\right)$$

$$Y=\frac{\frac{F}{A}}{\frac{\Delta l}{l}}$$

$$\Rightarrow Y\frac{\Delta l}{l}A=F$$

$$\Rightarrow F=AY\left(\frac{R-r}{r}\right)$$

35 **(2)**

When a ball is dropped on a floor,

$$y=\frac{1}{2}gt^2$$

So the graph between y and t is a parabola. Here as time increases, y decreases.

When the ball bounces back, then

$$y=ut+\frac{1}{2}gt^2$$

The graph between y and t will be a parabola. But here as time increases, y also increases.

36. **(1)**

Substance having more heat capacity takes longer time to get heated to a higher temperature and longer time to get cooled. If we draw a line parallel to the time axis, then it cuts the given graphs al three different points corresponding points on the time axis show that

$t_C > t_B > t_A$ or $C_C > C_B > C_A$

37. **(4)**

Considering the relation of escape velocity

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

The escape velocity does not depend upon the mass of body.

38. **(2)**

In a cyclic process, change in internal energy is zero.

$$\Delta_a U_a=0=\Delta_a U_b+\Delta_b U_c+\Delta_c U_a$$

Since process a-b is isothermal; change in internal energy = 0 since process b-c is adiabatic; Q = 0

$\therefore\ \Delta U=-\Delta W=4\text{J}$

39. **(4)**

We know that v_1 = 416 Hz, $l_1 = l$ and $l_2 = 2l$.

Also, m_1 = 4 kg and m_2 = ?

$$v_1=\frac{1}{2l_1}\sqrt{\frac{m_1 g}{\mu}} \quad ...(1)$$

$$v_2=\frac{1}{2l_2}\sqrt{\frac{m_2 g}{\mu}} \quad ...(2)$$

So, in order to maintain the same fundamental mode

$v_1 = v_2$

squaring both sides of equations (1) and (2) then equating

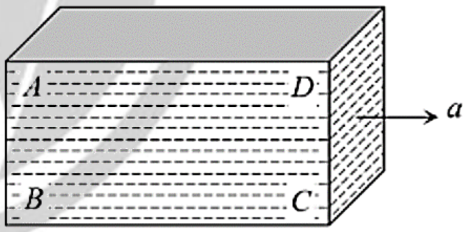
$$\frac{1}{4l^2}\frac{4g}{\mu}=\frac{1}{16l^2}\frac{m_2 g}{\mu}$$

$\Rightarrow m_2$ = 16 kg

40. **(1)**

If the tension in the cable of the elevator is the same as the weight of the elevator, it means that the net force on the system is zero. Therefore, the net acceleration of the system will also be zero. This means that the elevator is moving up or down with uniform speed.

41. **(1)**



Due to acceleration towards right, there will be a pseudo force in a left direction. So, the pressure will be more on rear side (Points *A* and *B*) in comparison with front side (Point *D* and *C*).

Also due to height of liquid column pressure will be more at the bottom (points *B* and *C*) in comparison with top (point *A* and *D*).

So overall maximum pressure will be at point *B* and minimum pressure will be at point *D*.

42. **(3)**

As volume of liquid will remain same.

⇒ Volume of larger drop = n × volume of smaller drop

$\Rightarrow \frac{4}{3}\pi R^3 = 64 \times \frac{4}{3}\pi r^3$

$\Rightarrow r = \frac{R}{4}$

We know that,

Work done = Surface Tension × change in surface area

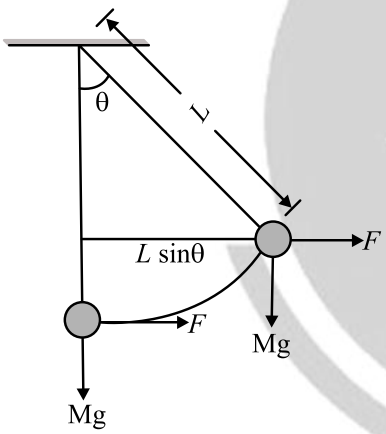
$\Rightarrow W = T \times \Delta A$

$= T(n \times 4\pi r^2 - 4\pi R^2)$

$= T\left[64 \times 4\pi\left(\frac{R}{4}\right)^2 - 4\pi R^2\right]$

= $12\pi R^2 T$

43. **(4)**



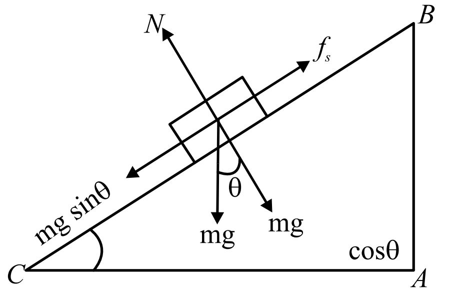
Work done by F, $W_F = F L \sin 45° = \frac{Fl}{\sqrt{2}}$

44. **(2)**

Centripetal force acts inward (towards the centre of the circular turn). This is provided by the frictional force. When the speed is large, required centripetal force to stay in the circular path increases. But friction is unable to provide large centripetal force and hence the body is thrown outwards.

45. **(1)**

Friction on always works in the opposite direction of the sliding hence the correct figure will be;



46. **(1)**

Work done in adiabatic process,

$W = \frac{nR(T_2 - T_1)}{\upsilon - 1}$

Put the values,

$146000 = \frac{1000 \times 8.3 \times 7}{\upsilon - 1}$

$\upsilon - 1 = 0.39$

$\upsilon \approx 1.4$

47. **(4)**

$C_v = dE/dT = \frac{3}{2}R$

$C_P = \frac{3}{2}R + R = \frac{5}{2}R = 2.5R$

48. **(2)**

F = kx

$W = \int F.dx = \int_0^x kxdx$

$W = \frac{kx^2}{2}$

49. **(2)**

i.e., $F \propto \frac{\Delta p}{\Delta t} \Rightarrow F = \frac{\Delta p}{\Delta t}$

Now, change in momentum

$\Delta p = F \times t = (10\,N) \times (10\,s) = 100\,kg$ m/s.

50. **(3)**

In SHM, the total energy is

E = $\frac{1}{2} m\omega^2 A^2$

where the symbols have their usual meanings.

$E \propto A^2$.