Sample Paper-02

Class 11th NEET (2024)

PHYSICS

ANSWER KEY

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

HINTS AND SOLUTION

1. **(4)**

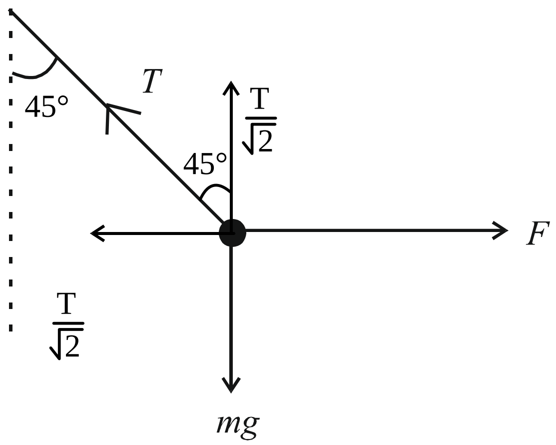
$TV^{\gamma-1} = \text{constant} \Rightarrow T_2 = T_1\left(\frac{V_1}{V_2}\right)^{\gamma-1} = 927^{o}\,C$

2. **(2)**

$g' = g\left(1-\frac{d}{R}\right) \Rightarrow \frac{g}{n} = g\left(1-\frac{d}{R}\right)$

$\Rightarrow \frac{d}{R} = 1-\frac{1}{n} \Rightarrow d = \left(\frac{n-1}{n}\right)R$

3. **(4)**



$\frac{T}{\sqrt{2}} = mg$ and $\frac{T}{\sqrt{2}} = F$

So, $F = mg = 100$ N

4. **(3)**

For a body to purely roll down the inclined plane, static friction will act at the contact point and the point will not slip on the surface. Hence work done by friction force is zero.

5. **(3)**

When the two waves overlap, there overlap would give a wave of amplitude zero. Since there would be no deformation in the wire. Hence there will be no potential energy. All the energy would be kinetic.

6. **(4)**

Work done by a gas in a process is: from the *PV* diagram is the area enclosed by the loop.

As we can see both loops *ABC* and *DEF* have the same area enclosed.

Hence $W_{ABC} = -W_{DEF}$

However, the magnitude are opposite.

7. **(4)**

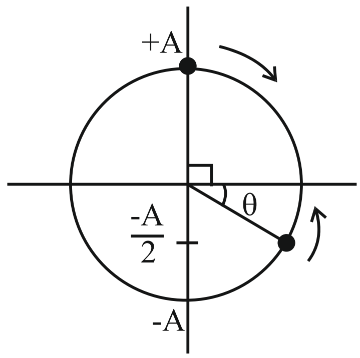
$a = \frac{\text{Net pulling force}}{\text{Total mass}} = \frac{10\times10-5\times10}{10+5} = \frac{10}{3}\,m/s^2$

$T - 5\times10 = 5\times a = \frac{50}{3}$

$\therefore \quad T = \frac{200}{3}$ N

This is also the reading of spring balance.

8. **(4)**



From the figure we can see that 'θ + 90°' is the phase angle here.

From the figure we can calculate 'θ' as

$\sin\theta = \frac{\left(\frac{A}{2}\right)}{A}$

$\Rightarrow \quad \sin\theta = \frac{1}{2}$

$\Rightarrow \quad \theta = \sin^{-1}\left(\frac{1}{2}\right)$

$\Rightarrow \quad \theta = 30°$

Therefore, we have the initial phase as 30° + 90° = 120°

Since the total initial phase angle between the particles is 120°, we can say that the phase angle covered by each particle will be half of the total initial phase, i.e. 60°.

We are given the total time period of the two particles at *T*. we know that time period is the time taken for one complete rotation, i.e. 360°.

Therefore, the time taken to complete 360° is *T*, then the time taken to travel 60° will be,

$\Rightarrow \quad \frac{T}{360}\times60 \Rightarrow \frac{T}{36}\times6 \Rightarrow \frac{T}{6}$

9. **(3)**

Fundamental frequency of the closed organ pipe is

$$v = \frac{v}{4L}$$

Here, $v = 340\ \text{ms}^{-1}$, $L = 85$ cm = 0.85 m

$$\therefore \quad v = \frac{340\,\text{ms}^{-1}}{4 \times 0.85\,\text{m}} = 100\,Hz$$

The natural frequencies of the closed organ pipe will be

$v_n = (2n - 1)\, v = v, 3v, 5v, 7v, 9v, 11v, 13v, \ldots$

= 100 Hz, 300 Hz, 500 Hz, 700 Hz, 900 Hz 1100 Hz, 1300 Hz, … and so on.

Thus, the natural frequencies lies below the 1250 Hz is 6.

10. **(4)**

For complementary angles projectiles, $\theta_1 + \theta_2 = 90^o$ and Range, R will be same for both projectiles.

Here, $T_1 = \dfrac{2u\sin\theta_1}{g}$ and

$$T_2 = \frac{2u\sin\theta_2}{g} = \frac{2u\cos\theta_1}{g} \text{ as } (\theta_2 = 90 - \theta_1)$$

$$R = \frac{u^2 \sin 2\theta_1}{g}$$

Thus,

$$T_1T_2 = \frac{2u^2(2\sin\theta_1\cos\theta_1)}{g^2} = \frac{(u^2\sin 2\theta_1)2}{g} = R\frac{2}{g}$$

or $R = \dfrac{1}{2} g T_1 T_2$

11. **(1)**

Decrease in potential energy = Work done against friction

$\therefore \quad mg\,(h + d) = F.d$

here F = average resistance

$$\Rightarrow \quad F = mg\left(1 + \frac{h}{d}\right)$$

12. **(2)**

Applying parallel axis theorem

$$I = I_{cm} + Mh^2 = \frac{ML^2}{12} + M\left(\frac{L}{4}\right)^2 = \frac{7ML^2}{48}$$

13. **(2)**

From Kepler's laws of planetary motion-

$$T = \frac{2\pi R^{3/2}}{\sqrt{GM}}, \frac{T_2}{T_1} = \left(\frac{R_2}{R_1}\right)^{3/2} = \left(\frac{4R}{R}\right)^{3/2} = 2^3 = 8$$

$\Rightarrow \quad T_2 = 8T_1$

$\therefore \quad T_2 = (84) \times 8$ min

14. **(2)**

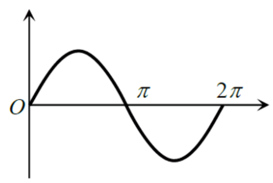
$\dfrac{v^2}{R} = a_t = \text{a}$ (Here, $a_t = a$)

or $\quad \dfrac{(at)^2}{R} = a$

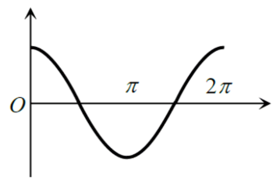
$$\therefore \quad t = \sqrt{\frac{R}{a}} = \sqrt{\frac{20}{5}} = 2s$$

15. **(1)**

A periodic function is one whose value repeats after a definite interval of time, sinθ and cosθ are periodic functions because they repeat itself after 2π interval of time.



sin curve



cos curve

16. **(4)**

Assertion: is false, in cyclin process only $\Delta U = 0$, $\Delta Q = \Delta W$.

Reason: is true, work done is not zero only change in internal energy is zero.

17. **(4)**

$$v_{\text{cm}} = \frac{m_1\vec{v}_1 + m_2\vec{v}_2 + \ldots. + m_n\vec{v}_n}{m_1 + m_2 + m_3 + \ldots. + m_n};$$

$$\therefore \quad (m_1 + m_2 + m_3 + \ldots. + m_n)\vec{v}_{\text{cm}}$$

$$= (m_1\vec{v}_1 + m_2\vec{v}_2 + \ldots. + m_n\vec{v}_n);$$

Option(A) is LHS of the above equation.

Option(B) is RHS of the above equation.

Hence, (A) and(B) are same.

Option(C) is correct since momentum can be defined for a body having translational motion, it may have additionally rotational and oscillatory motion.

18. **(2)**

$$v_x = \frac{dx}{dt} = 5$$

$$v_y = \frac{dy}{dt} = (4t + 1)$$

At 45°, $v_x = v_y$

$\therefore \quad 4t + 1 = 5$

or $\quad 4t = 4$

or $\quad t = 1$ sec

19. **(3)**

According to Wein's displacement law.

$\lambda_{\text{max}} T = \text{constant}$

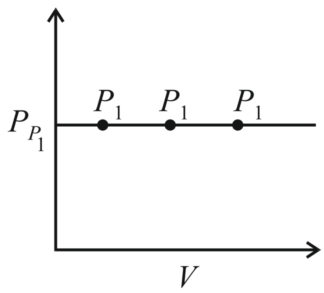
$\therefore \quad \frac{\lambda_{\text{max}_1}}{\lambda_{\text{max}_2}} = \frac{T_2}{T_1} \qquad T_1 = 1227 + 273 = 1500$ K

or $\quad \lambda_{\text{max}_2} = \frac{\lambda_{\text{max}_1 \times T_1}}{T_2} \qquad T_2 = (1000 + 1500)$ K

$= 2500$K

$$= \frac{5000 \times 1500}{2500} = 3000\,\text{Å}.$$

20. **(2)**



It is an isobaric process.

21. **(2)**

$F = kx \Rightarrow mg = kx \Rightarrow \; m \propto kx$

Hence, $\frac{m_1}{m_2} = \frac{k_1}{k_2} \times \frac{x_1}{x_2} \Rightarrow \frac{4}{6} = \frac{k}{k/2} \times \frac{1}{x_2}$

$\Rightarrow \quad x_2 = 3$ cm

22. **(1)**

The reflection coefficient of a black body is zero because black body absorbs all the radiation incident on it.

23. **(2)**

Work done by the gravitational force considered as positive when the two-point masses are brought from infinity to any two points in space.

Gravitational potential energy decreases during the above process.

24. **(2)**

Atomizer is a device that is used to emit liquid droplets as fine spray. 'Atomize' here means splitting up a large body into small, discrete particles. It works on Bernoulli's principle. Bernoulli's theorem is based on the conservation of energy.

25. **(4)**

Applying conservation of moles.

$n_1 + n_2 = n$

$\Rightarrow \quad \frac{P_1V_1}{RT} + \frac{P_2V_2}{RT} = \frac{PV}{RT}$

$\Rightarrow \quad P_1V_1 + P_2V_2 = PV$

$\Rightarrow \quad \left(\frac{4T}{r_1}\right)\left(\frac{4}{3}\pi r_1^3\right) + \left(\frac{4T}{r_2}\right)\left(\frac{4}{3}\pi r_2^3\right) = \left(\frac{4T}{r}\right)\left(\frac{4}{3}\pi r^3\right)$

$\Rightarrow \quad r_1^2 + r_2^2 = r^2$

$\Rightarrow \quad r^2 = \sqrt{3^2 + 4^2} = 5\,\text{cm}$

Hence the radius of the new bubble is 5 cm.

26. **(1)**

The kinetic energy of the system, but not the linear momentum of the system

Consider a bomb blast, where the internal chemical energy generates strong internal forces. The total kinetic energy of the fragments is much higher than that of the bomb before explosion. However, absence of external force result in no change in the total linear momentum of the system.

27. **(2)**

V is the orbital velocity. If Ve is the escape velocity, then $V_e = \sqrt{2}V$. The kinetic energy at the time of ejection.

$$KE = \frac{1}{2}mV_e^2 = \frac{1}{2}m\left(\sqrt{2}V\right)^2 = mV^2$$

28. **(1)**

For equilibrium of system,

$F_1 = \sqrt{F_2^2 + F_3^2}$, as $\theta = 90°$

In the absence of force F_1,

Acceleration $= \frac{\text{Net force}}{\text{Mass}}$

Acceleration $= \frac{\sqrt{F_2^2 + F_3^2}}{m} = \frac{F_1}{m}$

29. **(2)**

As $v=\sqrt{\dfrac{2gh}{1+\dfrac{I}{MR^2}}}$

Hence velocity is independent of the inclination of the plane and depends only on height h through which body descends. But because $t=\dfrac{1}{\sin\theta}\sqrt{\dfrac{2h}{g}+\dfrac{I}{MR^2}}$ depends on the inclination also, hence greater the inclination lesser will be the time of descend. Hence, in present case, the speeds will be same (because h is same) but time of descend will be different (because of different inclinations)

30. **(4)**

A stationary wave is called such because, there is no wave velocity.

This means that all parts of the wave have the same wave. They all attain maximum position at the some time. They go to mean position at the some time, and they go to rest and maximum velocity at the some time as well.

31. **(4)**

$Q_1 = Q_2$

$\therefore \quad ms_1(32-20) = ms_2(40-32)$

$\dfrac{s_1}{s_2}=\dfrac{8}{12}=\dfrac{2}{3}.$

32. **(3)**

We cannot say anything about the magnitude of the forces because it is not mentioned by how much time each of the forces has taken to increase/decrease the velocity. Hence, F_2 may be smaller than, greater than or equal to F_1.

33. **(1)**

$K_{max}=\dfrac{1}{2}mv_{max}^2=\dfrac{1}{2}\omega^2A^2\times m$

$\Rightarrow \quad \omega=\sqrt{\dfrac{2k}{mA^2}}=\sqrt{\dfrac{2\times8\times10^{-3}}{0.1\times(0.1)^2}}$ = 4 rad/s.

$x=A\sin\left(\omega t+\dfrac{\pi}{4}\right)=0.1\sin\left(4t+\dfrac{\pi}{4}\right)$

34. **(2)**

Isothermal ---Temperature is constant- (Internal energy constant)

Isobaric ---Pressure is constant

Isochoric---Volume is constant

Adiabatic ----$\Delta Q = 0$ There is no heat exchange.

35. **(4)**

$\Rightarrow$

$$\frac{H_1}{H_2}=\frac{\dfrac{u^2\sin^2\theta_1}{2g}}{\dfrac{u^2\sin^2\theta_2}{2g}}=\frac{\sin^2\theta_1}{\sin^2\theta_2}$$

$\theta_1=\dfrac{\pi}{3}\Rightarrow\theta_2=\dfrac{\pi}{2}-\dfrac{\pi}{3}=\dfrac{\pi}{6}$

$H_2=H_1\dfrac{\sin^2\theta_2}{\sin^2\theta_1}=102\times\dfrac{1/4}{3/4}=34\,\text{m}$

36. **(4)**

By applying $v^2 = u^2 - 2as \Rightarrow 0 = u^2 - 2$ as

$s=\dfrac{u^2}{2a},\ s\propto u^2$ [If retardation is constant]

If the speed of the bullet is double then bullet will cover four times distance before coming to rest i.e. $s_2 = 4(s_1) = 4(2s) \Rightarrow s_2 = 8s$

So, number of planks required = 8

37. **(3)**

Spring constant $(k)\propto\dfrac{1}{\text{Length of the spring}\,(l)}$

as length becomes half, k becomes twice is $2k$.

38. **(3)**

$U_c=-\dfrac{GMm}{R}, U_h=-\dfrac{GMm}{4R}$

$\Rightarrow \quad \Delta U=\dfrac{GMm}{R}-\dfrac{GMm}{4R}=\dfrac{3}{4}.\dfrac{GMm}{R}$

$=\dfrac{3}{4}mgR$

39. **(2)**

$\dfrac{I_{max}}{I_{min}}=\dfrac{(A_1+A_2)^2}{(A_1-A_2)^2}=\dfrac{225}{25}=\dfrac{9}{1}$

40. **(2)**

Power = Fv

$P = 4500 \times 2 = 9000$ W = 9 kW

41. **(2)**

$f_b=\dfrac{10}{3}=f_1-f_2=\dfrac{v}{1}-\dfrac{v}{1.01}$

Solving we get, v = 337m/s

42. **(2)**

$Fdt = mv - mu$ from work energy theorem

$F=\dfrac{m(v-u)}{dt}=\dfrac{5(65-15)}{2}=\dfrac{5\times50}{2}=125\,N$

43. **(2)**

At 4s

$u = at = 8$m/s

$s_1 = \frac{1}{2}at^2 = \frac{1}{2}\times 2\times 4^2 = 16m$

From 4s to 8s $\rightarrow$ $v = 8$ m/s

$a = 0$, $s_2 = v \times t = 8 \times 4 = 32m$

From 8s to 12s

$s_3 = s_1 = 16m$ $\quad\therefore\ s_{Total} = s_1 + s_2 + s_3 = 64m$

44. **(2)**

In the stable equilibrium, a body has minimum potential energy.

45. **(1)**

(A) $v = 8t$ m/s

$\Rightarrow$ $a = 8$ m/s^2 and at $t = 1s$ $v = 8$ m/s

(B) $v = 6t - 3t^2$

After some time v will be negative, so particle will change its direction.

$a = \frac{dv}{dt} = 6 - 6t$

So, I and II is matching.

(C) $x = 3t^2 + 2t$

$v = \frac{dx}{dt} = 6t + 2$, at $t = 1$s, $v = 8$ m/s

and $a = \frac{dv}{dt} = 6$ m/s^2 so a is constant.

Hence, III and IV is matching.

(D) $a = 16$t

$a \rightarrow$ variable

$a = \frac{dv}{dt}$

$\int dv = \int 16t\, dt$

$v = 8t^2$ at $t = 1$s, $v = 8$ m/s

So, II and III is matching.

46. **(3)**

$a_t = 3\text{m/s}^2, a_c = \frac{v^2}{r} = \frac{40\times 40}{400} = 4\text{m/s}^2$

$a_{\text{total}} = \sqrt{a_t^2 + a_c^2} = \sqrt{3^2 + 4^2} = 5\text{m/s}^2$

So, $x^{1/3} = 5$

$x = 125$

47. **(4)**

$\because$ $(\text{Height})_{\text{max}} = \frac{u^2 \sin^2\theta}{2g}$

$\Rightarrow$ $(\text{Height})_{\text{max}} \propto \sin^2\theta$

$\because$ $(H_{\text{max}})_1 = (H_{\text{max}})_2$

$\Rightarrow$ $\sin^2(\theta_1) = \sin^2(\theta_2)$

$\Rightarrow$ $\theta_1 = \theta_2$

$\because$ $T = \frac{2u\sin\theta}{g} \Rightarrow T \propto \sin\theta$

$\because$ $\theta_1 = \theta_2 \Rightarrow T_1 = T_2$

48. **(3)**

$a = v\frac{dv}{dx}$

$\frac{dv}{dx} = 10x \Rightarrow a = \left[5x^2 + 9\right]\times 10x \Rightarrow a = 50x^3 + 90x$

At $x = 1$ m, $a = 50 \times 1^3 + 90 \times 1$

$\Rightarrow$ $a = 50 + 90 = 140$ m/s^2

49. **(3)**

$U = \frac{1}{2}kx^2$

i.e. U versus x^2 graph is a straight line passing through origin.

50. **(2)**

$V = \frac{2r^2(\rho - \rho_0)g}{9\eta}$ where η is the coefficient of viscosity of medium.

Clearly $V \propto r^2$

$\Rightarrow$ $m \propto r^3$ $\quad\Rightarrow$ $V \propto (\text{m})^{2/3}$

$\Rightarrow$ $\frac{V_2}{V_1} = \left(\frac{m_2}{m_1}\right)^{2/3}$ $\quad\Rightarrow$ $\frac{V_2}{V} = \left(\frac{8\text{m}}{\text{m}}\right)^{2/3}$

$\Rightarrow$ $V_2 = 4V$