An Eye on Talent

Olympiad Aptitude Test
Physics
Class XII

1. n_1 is the frequency of the series limit of Lyman series, n_2 is the frequency of the first line of Lyman series and n_3 is the frequency of the series limit of the Balmer series. Then _____.

(A) $\frac{1}{\nu_2} = \frac{1}{\nu_1} + \frac{1}{\nu_3}$

(B) $\frac{1}{\nu_1} = \frac{1}{\nu_2} + \frac{1}{\nu_3}$

(C) $n_1 - n_2 = n_3$

(D) $n_1 = n_2 - n_3$

2. $_{92}U^{235}$ undergoes successive disintegrations with the end product of $_{82}Pb^{203}$. The Number of α and β particles emitted are

(A) $\alpha = 6, \beta = 4$

(B) $\alpha = 6, \beta = 0$

(C) $\alpha = 8, \beta = 6$

(D) $\alpha = 3, \beta = 3$

3. A battery of e.m.f. E has an internal resistance 'r'. A variable resistance R is connected to the terminals of the battery. A current I is drawn from the battery. V is the terminal P.D. If R alone is gradually reduced to zero, which of the following best describes I and V?

(A) I approaches E / r, V approaches E

(B) I approaches infinity, V approaches E

(C) I approaches zero, V approaches E

(D) I approaches E / r, V approaches zero

4. A body is projected vertically upwards. The times corresponding to height h while ascending and while descending are t_1 and t_2 respectively. Then the velocity of projection is (g is acceleration due to gravity)

(A) $g\sqrt{t_1 t_2}$

(B) $\frac{g t_1 t_2}{t_1 + t_2}$

(C) $\frac{g\sqrt{t_1 t_2}}{2}$

(D) $\frac{g(t_1 + t_2)}{2}$

5. A beam of light of wavelength 600 nm from a distant source falls on a single slit 1mm wide and the resulting diffraction pattern is observed on a screen 2m away. The distance between the first dark fringes on either side of the central bright fringe is _____.

(A) 1.2 mm

(B) 1.2 cm

(C) 2.4 cm

(D) 2.4 mm

6. A body of mass 5 kg is thrown vertically up with a kinetic energy of 490 J. The height at which the kinetic energy of the body becomes half of the original value is _____.
(A) 12.5 m
(B) 10 m
(C) 2.5 m
(D) 5 m

7. A particle of mass m is located in a one dimensional potential field where potential energy is given by:
V(x) = A(1 – cos px), where A and p are constants. The period of small oscillations of the particle is
(A) $2\pi\sqrt{\frac{m}{(Ap)}}$
(B) $2\pi\sqrt{\frac{m}{(Ap^2)}}$
(C) $2\pi\sqrt{\frac{m}{A}}$
(D) $\frac{1}{2\pi}\sqrt{\frac{Ap}{m}}$

8. A perfect gas at 27°C is heated at constant pressure so as to double its volume. The increase in temperature of the gas will be _____.
(A) 300°C
(B) 54°C
(C) 327°C
(D) 600°C

9. A plane progressive wave is given by y = 2 cos 6.284 (330 t – x). What is period of the wave?
(A) $\frac{1}{330}$ S
(B) $2\pi \times 330$ S
(C) $(2\pi \times 330)^{-1}$S
(D) $\frac{6.284}{330}$S

10. A plano-concave lens is made of glass of refractive index 1.5 and the radius of curvature of its curved face is 100 cm. What is the power of the lens?
(A) + 0.5 D
(B) – 0.5 D
(C) – 2 D
(D) + 2 D

11. A proton and a deuteron with the same initial kinetic energy enter a magnetic field in a direction perpendicular to the direction of the field. The ratio of the radii of the circular trajectories described by them is
(A) 1 : 2
(B) 1 : 1
(C) 1 : $\sqrt{2}$
(D) 1 : 4

12. A radioactive nucleus of mass number A, initially at rest, emits an α-particle with a speed v. The recoil speed of the daughter nucleus will be

(A) $\frac{2v}{A-4}$

(B) $\frac{2v}{A+4}$

(C) $\frac{4v}{A-4}$

(D) $\frac{4v}{A+4}$

13. A diver at a depth of 12 m in water $\left(\mu = \frac{4}{3}\right)$ sees the sky in a cone of semi vertical angle:

(A) $\sin^{-1}\left(\frac{4}{3}\right)$

(B) $\tan^{-1}\left(\frac{4}{3}\right)$

(C) $\sin^{-1}\left(\frac{3}{4}\right)$

(D) 90°

14. A Carnot's engine operates with source at 127°C and sinks at 27°C. If the source supplies 40 kJ of heat energy, the work done by the engine is

(A) 1 kJ

(B) 4 kJ

(C) 10 kJ

(D) 30 kJ

15. A body is moving with velocity 30 m/s towards east. After 10 seconds its velocity becomes 40 m/s towards north. The average acceleration of the body is

(A) 5 m/s^2

(B) 1 m/s^2

(C) 7 m/s^2

(D) 7 m/s^2

16. 310 J of heat is required to raise the temperature of 2 moles of an ideal gas at constant pressure from 25°C to 35°C. The amount of heat required to raise the temperature of the gas through the same range at constant volume is

(A) 452J

(B) 276J

(C) 144J

(D) 384J

17. Two waves are represented by the equations $y_1 = a\sin(\omega t + kx + 0.57)m$ and $y_2 = a\cos(\omega t + kx)m$, where x is in meter and t in s. The phase difference between them is

(A) 0.57 radian

(B) 1.0 radian

(C) 1.25 radian

(D) 1.57 radian

18. The maximum height attained by a projectile when thrown at an angle θ with the horizontal is found to be half the horizontal range. Then θ =

(A) $\text{Tan}^{-1}\frac{1}{2}$

(B) $\frac{\pi}{4}$

(C) $\frac{\pi}{6}$

(D) $\text{Tan}^{-1}2$

19. Out of the following functions representing motion of a particle which represents SHM?

(A) $y = \sin\omega t - \cos\omega t$

(B) $y = \sin^3\omega t$

(C) $y = 5\cos\left(\frac{3\pi}{4} - 3\omega t\right)$

(D) $y = 1 + \omega t + \omega^2 t^2$

(A) Only (A) and (B)
(B) Only (A)
(C) Only (D) does not represent SHM
(D) Only (A) and (C)

20. A ray of light is travelling from glass to air. (Refractive index of glass = 1.5) The angle of incidence is 50°. The deviation of the ray is

(A) $\text{Sin}^{-1}\left[\frac{\text{Sin}60^0}{1.5}\right] - 50^0$

(B) $50^0 - \text{Sin}^{-1}\left[\frac{\text{Sin}50^0}{1.5}\right]$

(C) 80^0

(D) 0^0