PART : PHYSICS

1. Train A is moving at 90 km/hr and train B is moving in the opposite direction at 54 km/hr. An observer in train A find that train B crosses him in 8 second. Find the length of train B :

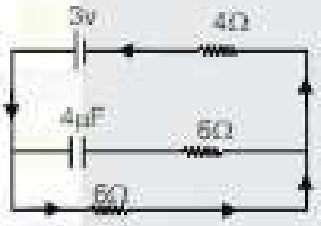
(1) 240 m (2) 320 m (3) 180 m (4) 360 m

Ans. (2)

Sol. $(90 + 54)\frac{5}{18} \times 8 = \ell$

$\ell = 320$ m

2.



Find charge on capacitor in steady state :

(1) 7.2 μC (2) 4.8 μC (3) 3.6 μC (4) 1.2 μC

Ans. (1)

Sol. $i = \frac{3}{10}$

$q = 4 \times 6 \times \frac{3}{10} = \frac{36}{5} = 7.2\ \mu C$

3. In the equation $\left(x - \frac{a}{y^2}\right)(y - b) = z$, x is pressure and y is volume dimensions of a/b will be same as

(1) Energy (2) Pressure (3) Volume (4) Density

Ans. (1)

Sol. $b = L^3$, $a = ML^{-1}T^{-2} \times L^6$

$a/b = ML^{-1}T^{-2} \times L^3 = ML^2T^{-2}$

4. **Statement-1 :** For a planet if $\frac{\text{mass}}{\text{radius}}$ ratio increases, then escape velocity increases.

Statement-2 : Escape velocity from surface is independent of radius of planet.

(1) Statement-1 is true, Statement-2 is false
(2) Statement-1 is false, Statement-2 is true
(3) Both Statement-1 and Statement-2 are true
(4) Both Statement-1 and Statement-2 are false

Ans. (1)

Sol. $V_e = \sqrt{\frac{2GM}{R}}$

Statement–1 is true & Statement 2 is false

5. In YDSE If ratio of amplitude of two incident waves is 2 : 1 find ratio of maximum & minimum intensity

(1) 9 (2) 2 (3) 3 (4) 8

Ans. **(1)**

Sol. $\frac{I_{max}}{I_{min}} = \frac{3^2}{1^2} = 9$

6. Two planet have radius R and 1.5 R and density ρ and 2ρ. Find the ratio of acceleration due to gravity at their surface :

(1) $\frac{1}{3}$ (2) $\frac{1}{2}$ (3) $\frac{1}{4}$ (4) $\frac{3}{1}$

Ans. **(1)**

Sol. $g = \frac{4}{2}\pi G\rho R$

$\frac{g_1}{g_2} = \frac{\rho_1}{\rho_2} \times \frac{R_1}{R_2} = \frac{1}{2} \times \frac{1}{3/2} = \frac{1}{3}$

7. If speed of a body is increased from 0 to u, increase in kinetic energy is E. If speed increases from u to 2u, then increase in kinetic energy is nE. Find n :

(1) 12 (2) 9 (3) 6 (4) 3

Ans. **(4)**

Sol. $E = \frac{1}{2}mu^2 - 0$

$nE = \frac{1}{2}m(2u)^2 - \frac{1}{2}mu^2$

$nE = \frac{1}{2}m \times 3u^2 = 3E$

$n = 3$

8. Given that three point charges are placed on a line As shown

$R = 2$ cm, $q = 2 \times 10^{-6}$ c

Find net force on $-2q$ charge :

(1) 5440 N (2) 5640 N (3) 3640 N (4) 4440 N

Ans. **(1)**

Sol. $\left|\frac{K2q\ q}{\left(\frac{3R}{4}\right)^2} - \frac{k\ 2q\ 2q}{\left(\frac{R}{4}\right)^2}\right| = \left|\frac{32kq^2}{9R^2} - \frac{64kq^2}{R^2}\right|$

$= \left[64 - \frac{32}{9}\right]\frac{kq^2}{R^2} = \left(64 - \frac{32}{9}\right)\frac{\times 9 \times 10^9 \times 4 \times 10^{-12}}{(2 \times 10^{-2})^2} = (64 \times 9 - 32) \times 10 = 5440\ N$

9. The displacement of a particle moving along a straight line is given by $s = 2.5t^2$. Find speed at $t = 5$ sec.

(1) 25 m/s (2) 20 m/s (3) 15 m/s (4) 30 m/s

Ans. (1)

Sol. $V = 5t = 25$ m/s

10. In simple harmonic motion, at what displacement from mean position, kinetic energy and potential energy are equal in magnitude, if amplitude of simple harmonic motion is A

(1) $\frac{A}{2}$ (2) $\frac{A}{\sqrt{2}}$ (3) $\frac{\sqrt{3}A}{2}$ (4) $\frac{A}{4}$

Ans. (2)

Sol. K.E. = P.E.

$$\frac{1}{2}m\omega^2\left(A^2-x^2\right)=\frac{1}{2}m\omega^2x^2$$

$$x=\pm\frac{A}{\sqrt{2}}$$

11. A charge Q is to be divided into two parts and kept at fixed separation such that the force of repulsion between them is maximum. Find charge of each part :

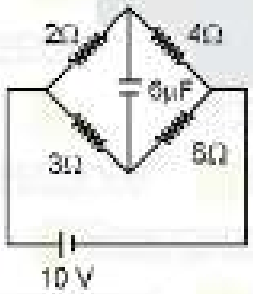
(1) $\frac{Q}{2},\frac{Q}{2}$ (2) $\frac{Q}{4},\frac{3Q}{4}$ (3) $\frac{Q}{8},\frac{7Q}{8}$ (4) $\frac{Q}{3},\frac{2Q}{3}$

Ans. (1)

Sol. $F=\frac{Kq(Q-q)}{r^2}$

F is max at $q = Q/2$

12.



Find energy stored in capacitor at steady state

(1) 0 V (2) 10 μJ (3) 20 μJ (4) 15 μJ

Ans. (1)

Sol. Bridge in balanced so energy stored will be zero

13. A hollow cylinder is free to rotate about its fixed axis. A string is tightly wrapped around it and pulled with 70 N force. If mass of cylinder is 70 kg and radius is 0.02 m, find its angular acceleration.

(1) $50\frac{rad}{sec^2}$ (2) $100\frac{rad}{sec^2}$ (3) $25\frac{rad}{sec^2}$ (4) $75\frac{rad}{sec^2}$

Ans. (1)

Sol. $FR = MR^2\alpha$

$$\alpha = \frac{F}{mR} = \frac{70}{70\times 0.02} = 50$$

14. In an adiabatic process volume is decreased from V_0 to $V_0/4$. If initial pressure was P_0 and adiabatic exponent for gas is γ, the new pressure will be :

(1) $P_0 4^{\gamma}$ (2) $\frac{P_0}{4^{\gamma}}$ (3) $P_0 4^{\gamma-1}$ (4) $\frac{P_0}{4^{\gamma-1}}$

Ans. (1)

Sol. $P_0V_0^{\gamma} = P\left(\frac{V_0}{4}\right)^{\gamma}$

$P = P_0 4^{\gamma}$

15. If an equi-convex lens has focal length 10 cm and it is cut into two equal parts along an axis perpendicular to principal axis, the power of each part obtained will be.

(1) 5 D (2) 10 D (3) 2.5 D (4) 7.5 D

Ans. (1)

Sol. $P = \frac{1}{f} = (\mu-1)\left(\frac{2}{R}\right)$

$P' = \frac{1}{f'} = (\mu-1)\left(\frac{1}{R}\right)$

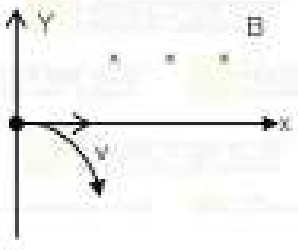
$\frac{P'}{P} = \frac{1}{2} \Rightarrow P' = \frac{1}{2}\times\frac{1}{0.1} = 5D$

16. An electron moving along +x axis in a uniform magnetic field in –z direction crosses origin, then the electron will be deflected in which direction :

(1) –Y (2) + Y (3) + Z (4) – Z

Ans. (1)

Sol.



17. In an electromagnetic wave, at an instant electric field is in +x direction and magnetic field is in −z direction, then direction of propagation of wave is

(1) +y (2) −y (3) x (4) −x

Ans. **(1)**

Sol. E × B is along velocity

18. Two rods are placed end to end, find the temperature of interface if temperature of free ends are 100°C & 0°C and coefficient of thermal conductivity of the rods are 84 S.I. unit and 126 S.I. units. Rods have same length & cross-sectional area :

(1) 40°C (2) 60°C (3) 50°C (4) 80°C

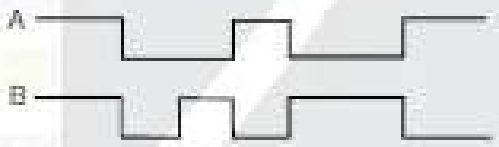
Ans. **(1)**

Sol. $\frac{100-T}{\frac{\ell}{84A}} = \frac{T-0}{\frac{\ell}{126A}}$

$8400 - 84T = 126\,T$

$T = \frac{8400}{210} = 40$

19. A NAND GATE input is given as shown. Output Y will be represented by :



(1)

(2)

(3)

(4)

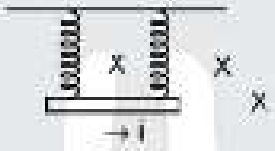
Ans. **(1)**

20. If the wavelength of electromagnetic wave to be transmitted by an antenna is λ, then minimum length of antenna required is :

(1) $\lambda/4$ (2) $\lambda/2$ (3) λ (4) $3\lambda/4$

Ans. **(1)**

21. Find the current to be given to rod placed in uniform magnetic field so that tension in springs becomes zero. Given : (ℓ = 50 cm, m = 40g, B = 0.4 T)



(1) 2A (2) 4A (3) 3A (4) 1A

Ans. **(1)**

Sol. $Bi\ell = mg$

$$i = \frac{mg}{B\ell} = \frac{\frac{40}{1000}\times 10}{0.4\times 0.5} = 2$$

22. **Statement-1** : For resonance in series circuit either inductor L or capacitor C should be connected to resistor R.

Statement-2 : power loss is maximum for resonance in series circuit.

(1) Statement-1 is true, Statement-2 is false

(2) Statement-1 is false, Statement-2 is true

(3) Both Statement-1 and Statement-2 are true

(4) Both Statement-1 and Statement-2 are false

Ans. **(3)**

23. **Statement–1** : Binding energy per nucleon for nucleus of element does not depend on atomic mass number

Statement–2 : If atomic mass number of element increases from A = 30 to A = 170, Binding energy per nucleon increase.

(1) Statement-1 is true, Statement-2 is false

(2) Statement-1 is false, Statement-2 is true

(3) Both Statement-1 and Statement-2 are true

(4) Both Statement-1 and Statement-2 are false

Ans. **(4)**

Sol. Both statements are wrong

24. **Statement-1** : Microwave, infrared rays and ultraviolet rays are incident on a metallic surface in photoelectric effect. The maximum kinetic energy of ejected electron least for infrared rays.

Statement-2 : threshold frequency of metal surface is inversely proportional to frequency of incident light.

(1) Statement-1 is true, Statement-2 is false

(2) Statement-1 is false, Statement-2 is true

(3) Both Statement-1 and Statement-2 are true

(4) Both Statement-1 and Statement-2 are false

Ans. **(1)**

Sol. statement 1 is true

statement 2 is false

25. At STP, the mean free path of gas molecule is 1500d when d is diameter of molecule what will be the mean free path at 373K at constant volume :

(1) 1500 d (2) $\frac{373}{273} \times 1500\,d$ (3) $\frac{273}{373} \times 1500\,d$ (4) $\sqrt{\frac{373}{273}} \times 1500d$

Ans. **(1)**

Sol. At constant volume temperature has no effect.