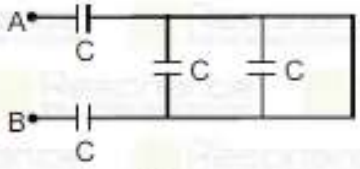
PART : PHYSICS

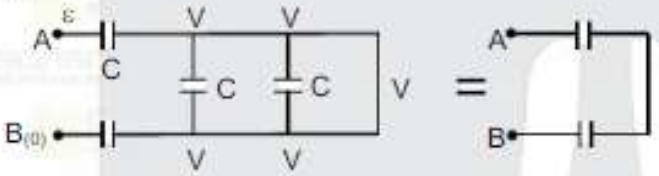
1. Find C_{eq} across A & B for the given network



(1) $\frac{C}{2}$ (2) $\frac{C}{4}$ (3) $\frac{C}{6}$ (4) $\frac{C}{8}$

Ans. **(1)**

Sol.



$C_{eq} = \frac{C}{2}$

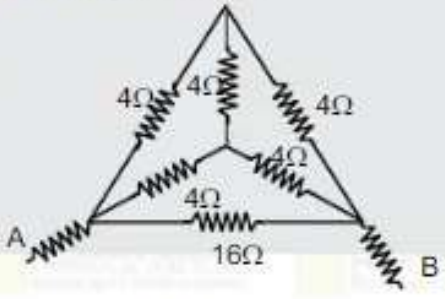
2. An object is placed 12 cm away perpendicularly from plane mirror. Virtual & erect image is formed. If the plane-mirror is moved 4 cm towards the object what will be displacement of image

(1) 8 cm away from object
(2) 8 cm towards object
(3) 4 cm away from object
(4) 4 cm towards object

Ans. **(2)**

Sol. D

3. Find R_{eq} across A & B for the network given below



(1) $\frac{16}{5}$ (2) $\frac{8}{5}$ (3) $\frac{3}{2}$ (4) $\frac{4}{5}$

Ans. **(1)**

Sol. $\frac{1}{R} = \frac{1}{8} + \frac{1}{8} + \frac{1}{16} = \frac{2}{8} + \frac{1}{16} = \frac{5}{16}$

4. If error in a,b,c,d is 1%, 2% , 3% & 4% respectively find error in ρ if $\rho = \frac{a^2b^3}{c\sqrt{d}}$.

(1) 11% (2) 13% (3) 10 % (4) 16%

Ans. **(2)**

Sol. $\frac{\Delta\rho}{\rho} = 2\frac{\Delta a}{a} + 3\frac{\Delta b}{b} + \left|\frac{-\Delta c}{c}\right| + \left|\frac{1}{2}\frac{\Delta d}{d}\right|$

$= 2 \times (1\%) + 3\times (2\%) + (3\%) + 2\% = 13\%$

5. Amplitude of carrier wave is 15 volt for message signal amplitude is 3 volt find ratio of maximum amplitude & minimum amplitude for the modulated signal.

(1) $\frac{1}{2}$ (2) $\frac{5}{2}$ (3) $\frac{3}{2}$ (4) $\frac{7}{2}$

Ans. **(3)**

Sol. $\frac{A_{max}}{A_{min}} = \frac{Ac + Ar}{Ac - Ar} = \frac{18}{12} = \frac{6}{4} = \frac{3}{2}$

6. 10-Resistors of 10Ω are given find ratio of maximum resistance & minimum resistance that can be attained from it.

(1) 25 (2) 12 (3) 16 (4) 10

Ans. **(4)**

Sol. For maximum, they must connected in series $R_{max} = 10 \times 10$

for minimum, they must be connected parallel $R_{min} = \frac{10}{10} = 1$

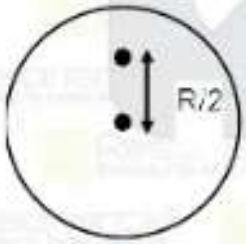
So, ratio = $\frac{10}{1} = 10$

7. Weight of a body on surface of earth is 200 N, then its weight at a depth R/2, R → radius of earth.

(1) 100 N (2) 200 N (3) 50 N (4) 25 N

Ans. **(1)**

Sol.



$g' = g(1-h/R)$

$g' = g(1-R/20R) = g(1-1/2) = g/2$

Weight at R/2 distance = 200/2 = 100 N

8. Angular momentum of electron in 1st orbit of hydrogen atom is L. electron jumps from 1st orbit to 2nd orbit. What will be the change in angular momentum of the electron.

(1) L/2 (2) 2L (3) L (4) 3L

Ans. (3)

Sol. Angular momentum of electron in nth orbit is $L = \frac{nh}{2\pi} \Rightarrow L \propto h$

$L_i = L$ and $L_f = 2L$

So $L_f - L_i = 2L - L = L$

9. Two satellites of masses m and 3m are revolving around the earth in two different orbits of radius R and 3R respectively. Find ratio of their orbital speeds.

(1) $\sqrt{3}$: 1 (2) $\sqrt{2}$: 1 (3) 1 : 1 (4) 3 : 2

Ans. (1)

Sol. Orbital speed

$V = \sqrt{\frac{GM}{r}} \quad \Rightarrow \quad V \propto \frac{1}{\sqrt{r}}$

$\frac{V_1}{V_2} = \sqrt{\frac{r_2}{r_1}} = \sqrt{\frac{3R}{R}} = \sqrt{3}$

10. A particle of mass M moving with a velocity v collides with a particle of mass 2m at rest and sticks to it. velocity of combined mass is equal to

(1) v (2) v/2 (3) v/3 (4) v/4

Ans. (3)

Sol. $P_i = P_f$

$mv + 0 = (m + 2m)v_c$

$v_c = \frac{v}{3}$

11. De-broglie wave length of a gas molecule to temperature 300 K is λ. what will be debroglie wavelength of same gas molecule at 600 K.

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

Ans. (2)

Sol. $\lambda = \frac{h}{P} = \frac{h}{\sqrt{2mk}} = \frac{h}{\sqrt{2m\frac{3}{3}kT}}$

So $\lambda \propto \frac{1}{\sqrt{T}}$

$\frac{\lambda_2}{\lambda_1} = \sqrt{\frac{T_1}{T_2}} = \sqrt{\frac{300}{600}} = \frac{1}{\sqrt{2}}$

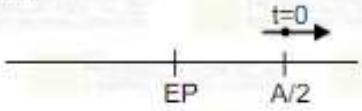
$\Rightarrow \lambda_2 = \frac{\lambda_1}{\sqrt{2}} = \frac{\lambda}{\sqrt{2}}$

12. A particle in SHM is crossing $+\frac{A}{2}$ & moving towards the extreme at t = 0. If its equation of SHM is $x = A\sin(\omega t + \delta)$, Find δ. (A is amplitude of SHM)

(1) 60° (2) 150° (3) 30° (4) 120°

Ans. **(3)**

Sol.



$\delta = \sin^{-1}\left(\frac{A/2}{A}\right) = 30°$

13. A mono-atomic gas is compressed from (P_0, V_0) to $\frac{V_0}{8}$ by two different process isothermally & adiabatically (separately). If final pressure of the gas in both the processes is P_1 & P_2 respectively then find ratio of P_1 & P_2.

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

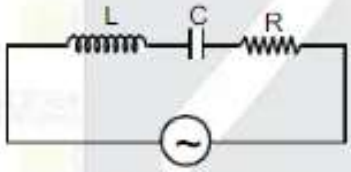
Ans. **(2)**

Sol. $P_0V_0^{\gamma} = P_2\left(\frac{V_0}{8}\right)^{\gamma}$ when $\gamma = 1 + \frac{2}{3} = \frac{5}{3}$

$\Rightarrow P_2 = P_0(8)^{\gamma} = P_0(8)^{5/3} = 32\,P_0$

Also $P_0V_0 = P_1\frac{V_0}{8} \Rightarrow P_1 = 8P_0$ So, $\frac{P_1}{P_2} = \frac{1}{4}$

14. **Statement 1 :** Power factor of L.C.R circuit is 1 in resonance condition.



Statement 2 : For resonance condition in LCR circuit, phase difference between V and I is zero

(1) Statement-1 and statement-2 both are correct

(2) Statement-1 and statement-2 both are incorrect

(3) Statement-1 is correct but statement-2 is incorrect

(4) Statement-1 is incorrect and statement-2 is correct

Ans. **(1)**

15. A particle is projected at an angle of 15° on the surface of the earth. its horizontal range is 50m. what will be the horizontal range of the particle if it is projected at an angle of 45° with same speed.

(1) 25 m (2) 100m (3) 200m (4) 75 m

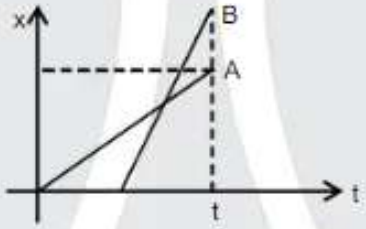
Ans. **(2)**

Sol. $R = \frac{u^2 \sin ce}{g} = \frac{u^2 \sin 2\times 15}{g} = \frac{u^2 \sin 30}{g} = \frac{u^2}{2g}$

$R^1 = \frac{u^2 \sin 2\times 45}{g} = \frac{u^2 \sin 90}{g} = \frac{u^2}{g}$

$\Rightarrow R^1 = 2R = 2\times 50 = 100$ m

16. Position time graph of two student A & B is shown when both starts from school and reaches to home as shown in graph.



(A) A moving faster then B (B) B moving faster then A

(C) A lives near school (D) B lives near school.

(E) A takes more time to reach home then B

(1) ABD (2) BCD (3) BCE (4) BD

Ans. **(3)**

17. length of a long solenoid is 60 cm & total No. of turns in the solenoid are 15. If magnetic intensity is 2.4 Am than find current in the solenoid.

(1) 0.096A (2) 0.054A (3) 0.96 A (4) 0.54A

Ans. **(1)**

Sol. $n = \frac{N}{\ell} = \frac{15\times 100}{60} = 25$

$H = ni \Rightarrow 1 = \frac{H}{n} = \frac{2.4}{25}$

$= 0.096$ A

18. **Statement-1:** No. of turns of galvanometer is doubled then current sensitivity becomes doubled

Statement-2: Keeping all other factor same if no. of turns increase then voltage sensitivity increase by same ratio.

(1) Statement-1 and statement-2 both are correct

(2) Statement-1 and statement-2 both are incorrect

(3) Statement-1 is correct but statement-2 is incorrect

(4) Statement-1 is incorrect and statement-2 is correct

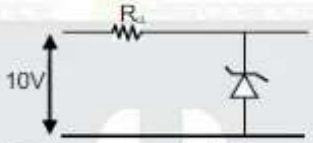
Ans. **(3)**

Sol. Statement (1) is correct & statement (2) is incorrect

$$C.S = \frac{0}{i} = \frac{NAB}{C}$$

$$V.S. = \frac{0}{V} = \frac{NAB}{CR}$$

19. Power across zener diode is 1.6 watt and Break down voltage is 8 Volt. If input voltage are from 3V to 10V then R_s will be



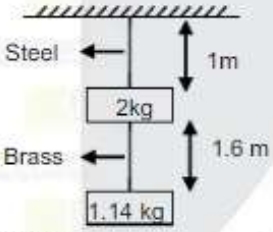
(1) 10 Ω (2) 13.33 Ω (3) 18 Ω (4) 20 Ω

Ans. **(1)**

Sol. $I = \frac{P}{V} = \frac{1.6}{8} = 0.2A$

$$R_s = \frac{V_R}{I} = \frac{2}{0.2} = 10\Omega$$

20.



Given

$Y_s = 2 \times 10^{11}$, r = 0.2 cm (same)

elongation in steel wire will $n \times 10^{-6}$ m, then n will be

(1) 10 (2) 20 (3) 05 (4) 04

Ans. **(2)**

Sol. $\Delta\ell = \frac{T\ell}{Ay} = \frac{3.14 \times 10 \times 1.6}{\pi(2 \times 10^{-3})^2 \times 2 \times 10^{11}}$

$$= \frac{16}{8} \times 10^{-5}$$

$$= 2 \times 10^{-5} \text{ m} = 20 \times 10^{-6}$$

21. In Electromagnetic waves, energy of small volume oscillates with

(1) Double the frequency of wave

(2) Same as the frequency of wave

(3) does not change.

(4) half the frequency of wave.

Ans. **(1)**

Sol. $V_E = \frac{1}{2}\varepsilon E_0^2(\Delta V)$

$= \frac{1}{2}\varepsilon E_0^2 \sin^2(\omega t - kx)\Delta V$

$= \frac{1}{2}\varepsilon E_0^2[(1 - \cos 2(\omega t - kx)]\Delta V$

$U_B = \frac{1}{2}\frac{B_0^2}{\mu_0}[(1-\cos 2(\omega t - kx)]\Delta V$

Frequency of U_E and U_B is double of frequency of electromagnetic wave.

22. **Statement–I :** In a water reservoir pressure will be same at same horizontal level.
Statement–II : If pressure applied in a closed reservoir then it will distribute equally.

(1) Statement-1 and statement-2 both are correct

(2) Statement-1 and statement-2 both are incorrect

(3) Statement-1 is correct but statement-2 is incorrect

(4) Statement-1 is incorrect and statement-2 is correct

Ans. **(1)**