JEE MAIN-2011

PHYSICS

21. Sol. (C)

When $\theta = 0°$, maximum light is transmitted. At $\theta > \theta_c$ (critical angle), no further light is transmitted

22. Sol. (A)

Time period of spring block system depends on spring constant and mass of block. On applying electric field only the equilibrium position gets shifted.

23. Sol. (C)

$$P = \frac{M}{\frac{4}{3}\pi r^3}, 100\times\frac{\Delta P}{P} = \left(\frac{\Delta M}{M} + \frac{3\Delta r}{r}\right)\times 100$$

$$\Delta r = \text{least count} = 0.01 \Rightarrow r = 2.72$$

$$\frac{\Delta P}{P}\times 100 = 2\% + \left(3\times\frac{0.01}{2070}\right)\times 100 = 3.1\%$$

24. Sol. (D)

$$0.01\,V = 0.2u + 0.01\times 5u$$

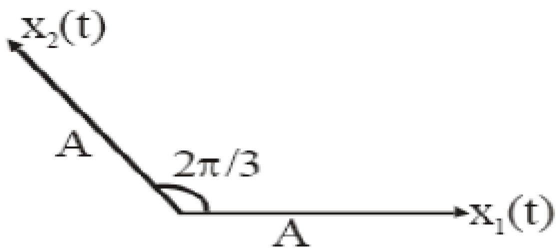
Time of light $t = 1s$: Range for ball $= u\times t \Rightarrow 20 = u\times 1 \Rightarrow u = 20\,\text{m/s}$

$$\Rightarrow V = 500\,\text{m/s}$$

25. Sol. (C)

Magnetic field lines and induced electric field lines always from closed loop.

26. Sol. (B)



$x_1(t)+x_2(t)+x_3(t)=0$

$x_3(t)$ has to be such that resultant is zero.

So it should make $\frac{4\pi}{3}$ from $x_1(t)$ anticlockwise.

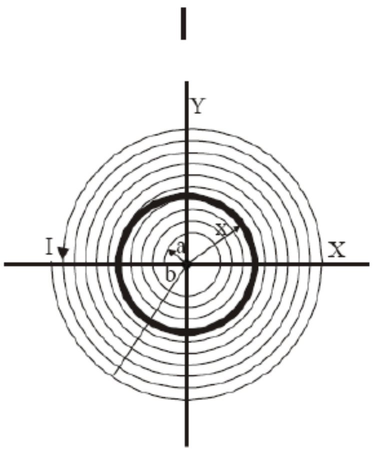
27. Sol. (A)

Taking an elemental strip of radius x and width dx.

Area of strip $=2\pi x\,dx$

Number of turns through area $=\frac{N}{b-a}dx$

$$\int dB=\int_a^b \frac{\mu_0 \frac{N}{(b-a)} I dx}{2x}=\frac{\mu_0 N I \ell n\left(\frac{b}{a}\right)}{2(b-a)}$$



28. Sol. (B)

KE of object $= \frac{1}{2}mv^2$ when it moves with satellite ; PE of object $= -mv^2$

At die time of ejection $KE + PE = 0$ to make it escape from gravitational pull.

$KE = mv^2$.

29. Sol. (ABD)

$F_{\text{Buoyant}} = (m_a + m_B)g; 2vd_F g = v(d_A + d_B)g$

$d_A + d_B = 2d_F$. Therefore a, b, d

30. Sol. (CD)

The field distribution for a dipole cannot be calculated by using Gauss law only, therefore (CD)

31. Sol. (BC)

X_C decreases therefore impedence decreases and current increases. $I_B > I_A$

As I_B increases die voltage across 'R' increases therefore V_C decreases.

32. Sol. (AC)

Since momentum of ball and ring has same magnitude but they are opposite in direction and final momentum of ball after the collision in Horizontal direction is zero, therefore the ring has pure rotation about its stationary CM just alter collision (assuming non-impulsive friction).

33. Sol. (5)

$$v_{AB} = \frac{\frac{6}{1}+\frac{3}{2}}{\frac{1}{1}+\frac{1}{2}} = \frac{\frac{15}{2}}{\frac{3}{2}} = 5$$

34. Sol. (4)

$$1.25R^2 = R^2 + \left(\frac{1}{\omega c}\right)^2$$

$$0.25R^2 = \left(\frac{1}{\omega c}\right)^2; 0.5R = \frac{1}{500 \times C}; C = \frac{1}{250R}; RC = \frac{1}{250}\text{sec}$$

$$\tau = 4\,\text{millisecond}; \tau = 4$$

35. Sol. (5)

With respect to train:

Velocity : Acceleration :

$$T = \frac{2v_y}{g} = \frac{2\times 5\sqrt{3}}{10} = \sqrt{3}$$

$$1.15 = 5t - \frac{1}{2}at^2 \Rightarrow a = 5\,\text{m/s}^2$$

36. Sol. (2)

First refraction:

$$\mu_1 = 1, u = -24, \mu_2 = \frac{7}{4}, R = +6, \frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$$

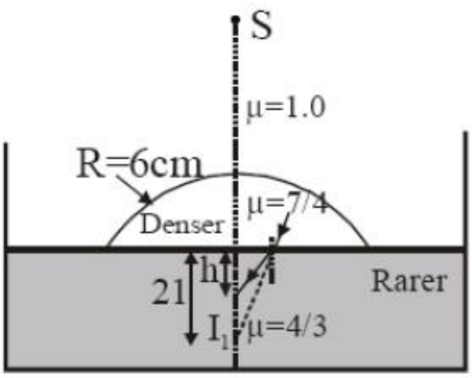
After solving $v = 21$

Now for second refraction :

$$h = \frac{21}{(21/16)} = 16$$

So, from bottom $18 - 16 = 2$

So, $x = 2$



37. Sol. (4)

$$-\mu mgx-\frac{1}{2}kx^2=0-\frac{1}{2}mv^2$$

$$v^2=\frac{1.44}{9}=\frac{4}{10}\Rightarrow N=4$$

38. Sol. (7)

$$\frac{hc}{\lambda}-\phi=eV=e\frac{(Ne)K}{R}$$

$$\left(\frac{1240}{200}-4.7\right)1.6\times10^{-19}=\frac{N\left(1.6\times10^{-19}\right)^2 9\times10^9}{1/100}$$

$$\frac{15}{1.6}\times10^7=N$$

39. Sol. (A) p.r,t (B) p,r (C) q,s (D) r,t

For (A) : In process AB (isobaric compression)

Work is negative, ΔU is negative , ΔQ is negative

For(B): BC process (Isochoric)

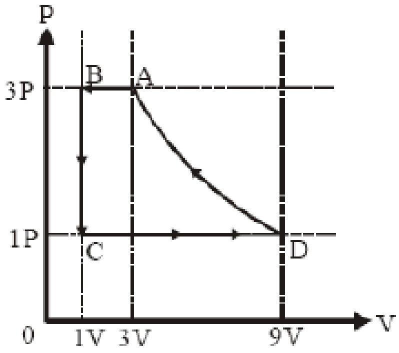
Work is zero, ΔU is negative, ΔQ is negative

For(C) : CD Process (Isobaric expansion)

Work is negative, ΔU is positive , ΔQ is positive

For (D) : DA Process ($V =$ decreases Isothermal)

Work is negative, ΔU is zero, ΔQ is negative



40. Sol. (A) p,t (B) p,s (C) q.s (D) q,r

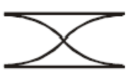
For (A): Sound wave is longitudinal wave

 $\frac{\lambda_F}{4} = L \Rightarrow \lambda_F = 4L$

For (B): Sound wave is longitudinal wave

 $\frac{\lambda_F}{2} = L \Rightarrow \lambda_F = 2L$

For (C): String wave is transverse

 $\frac{\lambda_F}{2} = L \Rightarrow \lambda_F = 2L$

For (D):  $\lambda_F = L \Rightarrow \text{so}(q \,\&\, r)$