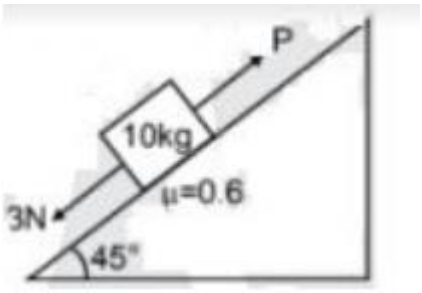
JEE MAINS – 2019

PHYSICS

1: A block of mass 10 kg is kept on a rough inclined ash shown in figure. The coefficient of friction between the block and the surface is 0.6 . Two forces of magnitudes 3 N & P N are acting of the block as shown figure. If friction on the block is acting upwards, then minimum value of P for which the block remains at rest is :



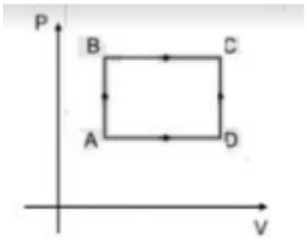
(1) 64 N

(2) 32 N

(3) 12 N

(4) 3 N

2: For path ABC , Heat given to the system is 60 J and work done by the system is 30 J . For path ADC , work done by the system is 10 J . The heat given to the system for path ADC is



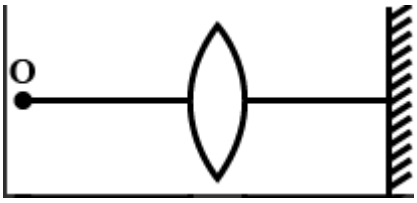
(1) 100 J

(2) 80 J

(3) 40 J

(4) 60 J

3: Initially an object is kept at a distance of $10\ \text{cm}$ from the convex lens and a sharp image is formed at $10\ \text{cm}$ ahead of lens on the screen. Now a glass plate ($\mu = 1.5$) of thickness $1.5\ \text{cm}$ is placed between object and lens. The distance by which the screen be shifted to get sharp image on the screen will be,



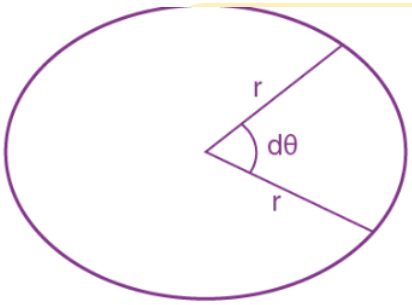
(1) $\frac{9}{5}$ cm

(2) $\frac{5}{9}$ cm

(3) 1 cm

(4) 5 cm

4: A planet of mass m having angular momentum L is revolving around the sun. The aerial velocity of the planet will be



(1) $\frac{L}{m}$

(2) $\frac{L}{2m}$

(3) $\frac{2L}{m}$

(4) $\frac{L}{4m}$

5: The velocity of a particle $\vec{v}$ at any instant is $\vec{v} = y\hat{i} + x\hat{j}$. The equation of trajectory of the particle is:

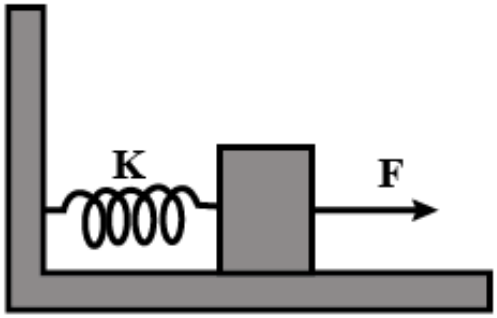
(1) $x^2 + y^2 = \text{constant}$

(2) $y^2 = x^2 + \text{constant}$

(3) $xy = \text{constant}$

(4) None of these

6: A block of mass m is connected to a spring of force constant k. Initially the block is at rest and the spring has natural length. A constant force F is applied horizontally towards right. The maximum speed of the block will be (there is no friction between block and the surface)



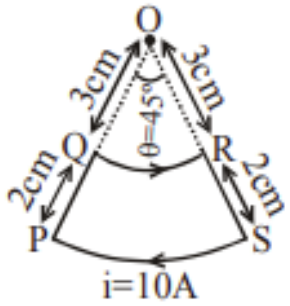
(1) $\frac{F}{\sqrt{mK}}$

(2) $\frac{2F}{\sqrt{mK}}$

(3) $\frac{F}{2\sqrt{mK}}$

(4) $\frac{F}{\sqrt{2mK}}$

7: A current loop, having two circular arcs joined by two radial lines is shown in the figure. It carries a current of $10\ \text{A}$. The magnitude of field at point O will close to,



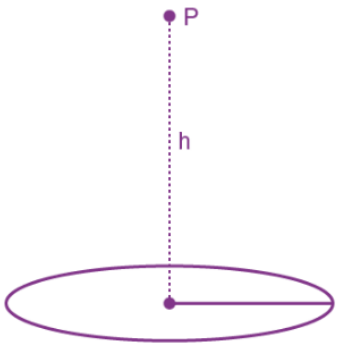
(1) 1.5×10^{-5}

(2) 10^{-5}

(3) 2×10^{-5}

(4) 10^{-4}

8: Charge Q is uniformly distributed over a ring of radius R. The height h, on the axis of the ring at which electric field is maximum



(a) $\frac{R}{\sqrt{2}}$

(b) $\frac{R}{2}$

(c) R

(d) None of these

9: Two radioactive elements $A \& B$ have initially activity 10 curie & 20 curie respectively. If A has twice the no. of moles as that of B. The decay constant λ_A & λ_B can be

(1) $(10,5)$

(2) $(5,20)$

(3) $(20,10)$

(4) $(50,100)$

10: A conducting loop of resistance $10\ \Omega$ and area $3.5\times10^{-3}\ \text{m}^2$ is placed in uniform and time varying magnetic field $B=0.4\sin(50\pi t)$. The Charge passing through the loop in $t=0$ to $t=10$ ms is

(1) 140 μC

(2) 70 mC

(3) 280 mC

(4) 100 mC

11: If current in a current carrying wire is 1.5 A, number of free electrons per unit volume is $9\times10^{28}m^3$ and area of cross section is $5\ \text{mm}^2$. Drift velocity of electrons will be

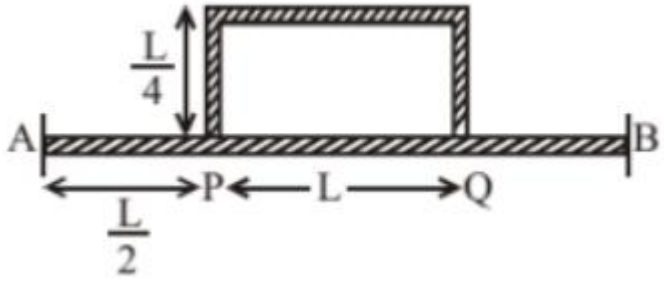
(1) 0.2 mm/s

(2) 2 m/s

(3) 0.02 mm/s

(4) None of these

12: Temperature difference of $120^{\circ}C$ is maintained between two ends of a uniform rod AB of length $2L$. Another bent rod PQ, of same cross section as AB and length $\frac{3L}{2}$, is connected across AB (See figure). In steady state, temperature difference between P and Q will be close to



(1) 30

(2) 45

(3) 60

(4) 75

13: Three blocks m, m and M are kept on a frictionless floor as shown in figure. The left most block is given velocity v towards right. All the collisions between the blocks are perfectly inelastic. The loss in kinetic energy after all the collisions is $\frac{5^{th}}{6}$ of initial kinetic energy. The ratio of M/m will be:

(1) $\frac{1}{8}$

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

(3) 4

(4) 2

14: A mixture of 2 moles of helium gas (atomic mass $=4$ amu) and 1 mole of argon gas (atomic mass $=40$ amu) is kept at 300 K in a container. The ratio of the rms speeds $\left(\frac{v_{rms}(\text{helium})}{v_{rms}(\text{argon})}\right)$ is,

(1) 0.32

(2) 0.45

(3) 2.24

(4) 3.16

15: Light of wavelength $\lambda_1 = 340$ nm and $\lambda_2 = 540$ nm are incident on a metallic surface. If the ratio of the speed of the electrons ejected is 2. The work function of the metal is,

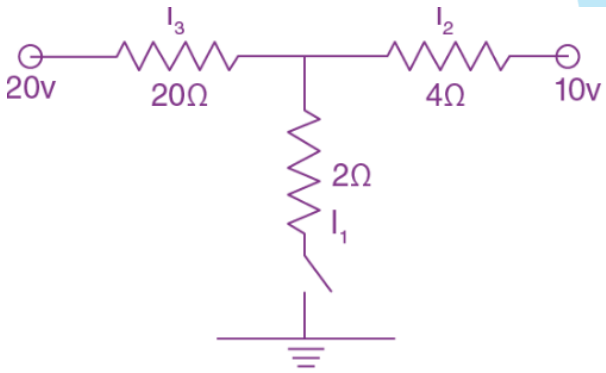
(1) 1 eV

(2) 1.85 eV

(3) 1.5 eV

(4) 2 eV

16: Value of i_1 (Ampere) when switch is closed is,



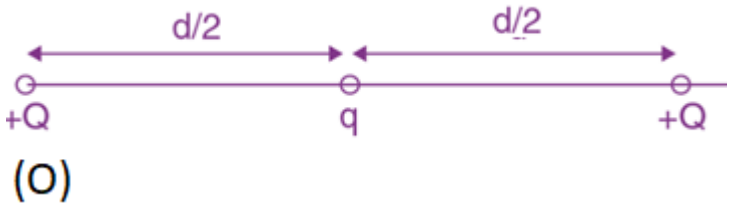
(1) 2

(2) 5

(3) 10

(4) 1

17: If net force on charge kept at O is zero. The value of charge q is;



(1) $\frac{+Q}{2}$

(2) $\frac{-Q}{2}$

(3) $\frac{+Q}{4}$

(4) $\frac{-Q}{4}$

Q18: If value of electric field 6.3×10^{27} volt m^{-1} for a electromagnetic wave. The value of magnetic field B is

(1) 5×10^{-19} T

(2) 2×10^{19} T

(3) 5×10^{-20} T

(4) 2.1×10^{20} T

Q19: Two coherent light sources having intensity $I_1 \& I_2$. If ratio of $\frac{I_{max}}{I_{min}}$ is $6:1$. Find $\frac{I_1}{I_2}$?

(1) $\frac{16}{9}$

(2) $\frac{9}{16}$

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

(4) $\frac{25}{9}$

20. If length of resistance wire is increased by 0.5% keeping the volume constant, then change in resistance will be

(1) 0%

(2) 1%

(3) 0.5%

(4) 2%

21. A uniform L shaped rod each of side A is held as shown in the figure. The angle θ such that rod remain stable will be,

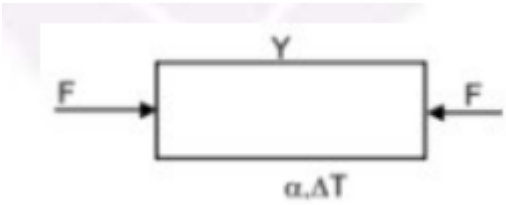
(1) $\tan^{-1}\left(\frac{1}{2}\right)$

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

(3) $\tan^{-1} 2$

(4) $\tan^{-1} 1$

22: A rod of acted by two equal forces as shown in the figure. The coefficient of thermal expansion of the rod is α and area of cross section is A. When the temperature the rod increased by Δt. The length of the rod does not change. The young's modulus Y will be



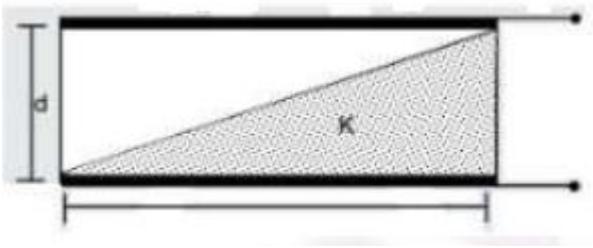
(1) $\frac{F}{2A\alpha\Delta T}$

(2) $\frac{F}{A\alpha\Delta T}$

(3) $\frac{2F}{A\alpha\Delta T}$

(4) $\frac{F}{3A\alpha\Delta T}$

23: A capacitor is formed by two square metal-plates of edge a, separated by a distance d. Dielectric of dielectric constants K is filled in the gap as shown in the figure. The equivalent capacitance is



(1) $\frac{k\varepsilon_0 a^2 Ink}{d(k-1)}$

(2) $\frac{k\varepsilon_0 a^2 Ink}{d(k-2)}$

(3) $\frac{k\varepsilon_0 a^2 Ink}{2d(k-1)}$

(4) $\frac{2k\varepsilon_0 a^2 Ink}{d(k-1)}$

24: In a semiconductor mobility of electron, i.e. drift velocity per unit applied electric field is 1.6 (S.I. unit). Density of electron is $10^{19}\ m^{-3}$. (Neglect holes concentration). Resistivity of semiconductor is

(1) $0.4\Omega m$

(2) $2\Omega m$

(3) $4\Omega m$

(4) $0.2\Omega m$

25: A block of mass M is hanging by a string of negligible mass in a car. The speed of wave in the string $60\,ms^{-1}$. Now car is accelerated horizontally by an acceleration a the speed of wave in the string is $60.5\,ms^{-1}$. What is a in terms of g?

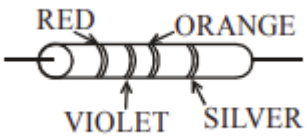
(1) $\frac{g}{5}$

(2) $\frac{g}{10}$

(3) $\frac{g}{\sqrt{30}}$

(4) $\frac{g}{30}$

26: A resistance is shown in the figure. Its value and tolerance are given respectively by:



(1) $27K\Omega$, 20%

(2) $270K\Omega$, 5%

(3) $270K\Omega$, 10%

(4) $27K\Omega$, 10%

27: A bar magnet is demagnetized by inserting it inside a solenoid of length 0.2 m, 100 turns, and carrying a current of $5.2\ A$. The coercivity of the bar magnet is :

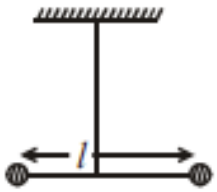
(1) 1200 A/m

(2) 2600 A/m

(3) 520 A/m

(4) 285 A/m 285 A/m

28: Two masses m and $\frac{m}{2}$ are connected at the two ends of a massless rigid rod of length l. The rod is suspended by a thin wire of torsional constant k at the centre of mass of the rod-mass system(see figure). Because of torsional constant k, the restoring torque is $\tau = k\theta$ for angular displacement 0. If the rod is rota ted by θ_0 and released, the tension in it when it passes through its mean position will be:



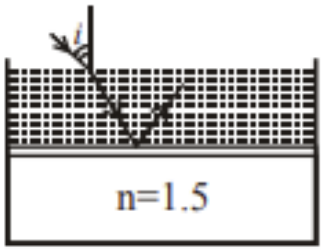
(1) $\frac{3k\theta_0^{\ 2}}{\ell}$

(2) $\frac{k\theta_0^{\ 2}}{2\ell}$

(3) $\frac{2k\theta_0^{\ 2}}{\ell}$

(4) $\frac{k\theta_0^{\ 2}}{\ell}$

29: Consider a tank made of glass(refractive index 1.5) with a thick bottom. It is filled with a liquid of refractive index μ,. A student finds that, irrespective of what the incident angle i (see figure) is for a beam of light entering the liquid, the light reflected from the liquid glass interface is never completely polarized. For this to happen, the minimum value of μ is :



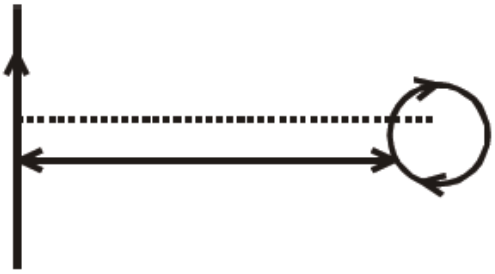
(1) $\frac{3}{\sqrt{5}}$

(2) $\frac{5}{\sqrt{3}}$

(3) $\sqrt{\frac{5}{3}}$

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

30: An infinitely long current carrying wire and a small current carrying loop are in the plane of the paper as shown. The radius of the loop is a and distance of its centre from the wire is d $d >> a$. If the loop applies a force F on the wire, then :



(1) $F \propto \left(\frac{a^2}{d^3}\right)$

(2) $F \propto \frac{a}{d}$

(3) $F \propto \left(\frac{a}{d}\right)^2$

(4) $F = 0$