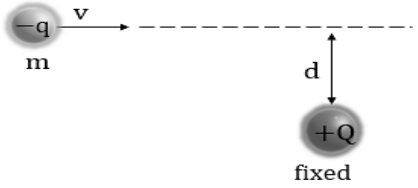
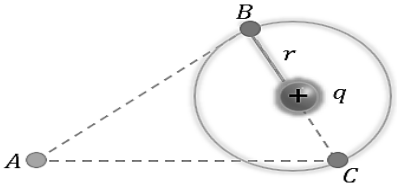
Q.1 Figure shows a charge +Q clamped at a point in free space. From a large distance another charge particle of charge −q and mass of m is thrown towards +Q with an impact parameter d as shown with speed v. How many positions for minimum separation would be attained for the particle.



(A) 1 **(B)** 2 **(C)** 3 **(D)** 4

Q.2 A point charge q held at the centre of a circle of radius r. Points B and C are two fixed points on the circumference of the circle and A is a point outside the circle as shown. If W_{AB} represents the work done by electric field in taking a charge q_0 from A to B and W_{AC} represents the work done from A to C, then



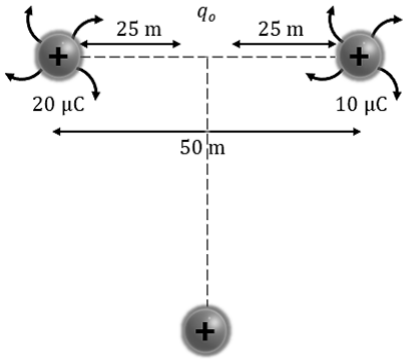
(A) $W_{AB} > W_{AC}$ **(B)** $W_{AB} < W_{AC}$ **(C)** $W_{AB} = W_{AC} \neq 0$ **(D)** $W_{AB} = W_{AC} = 0$

Q.3 When a 2 μC charge is carried from point *A* to point *B*, the amount of work done by the electric field is 50 μJ. Find the potential difference and also find which point is at a higher potential.

(A) 25 V, *B* **(B)** 25 V, *A*

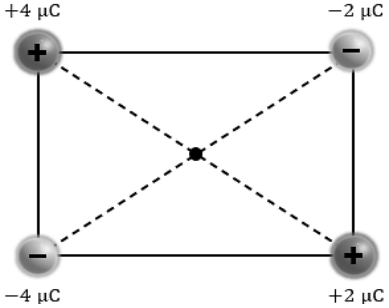
(C) 20 V, *B* **(D)** Both are at the same potential

Q.4 A unit positive charge has to be brought from infinity to a mid-point between two charges, 20 μC and 10 μC separated by a distance of 50 m. How much work will be required by an external force?



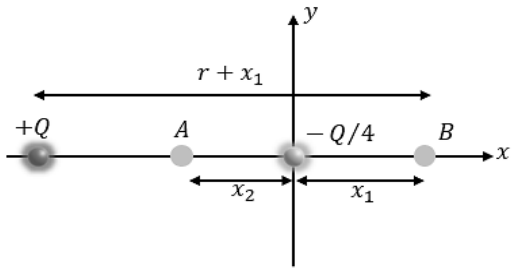
(A) 0.1×10^4 J **(B)** 1.1×10^4 J **(C)** 2.1×10^4 J **(D)** 3.1×10^4 J

Q.5 Four charges are placed on the vertices of a square as shown in figure. The net Electric potential at centre of the square is



(A) Zero **(B)** 10 V **(C)** 15 V **(D)** 29 V

Q.6 Two-point charges Q and $-\frac{Q}{4}$ placed along the $x-$ *axis* are seperated by a distance r. Take $-\frac{Q}{4}$ as origin and it is placed at the right of Q. Then the potential is zero



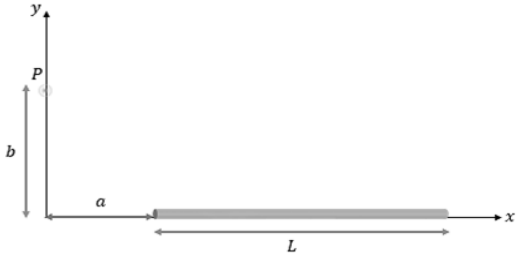
(A)at $x=\frac{r}{3}$ only

(B)at $x=-\frac{r}{5}$ only

(C)both at $x=\frac{r}{3}$ and at $x=-\frac{r}{5}$

(D)there exists two points on the axis where the electric field is zero

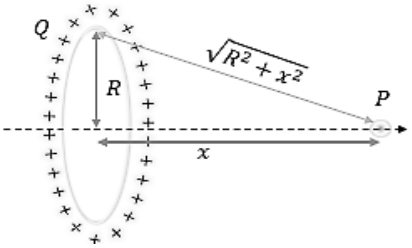
Q.7 Calculate the electric potential at the point P due to the given charged rod of length L having charge per unit length λ.



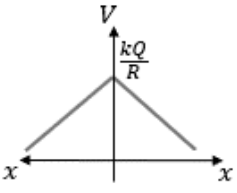
(A) $V=k\lambda\, ln\left\{\frac{a+L+\sqrt{b^2+(a+L)^2}}{a+\sqrt{b^2+a^2}}\right\}$ **(B)** $V=2k\lambda\, ln\left\{\frac{a+L}{a}\right\}$

(C) $V=2k\lambda\, ln\left\{\frac{a+L+\sqrt{b^2+(a+L)^2}}{a+\sqrt{b^2+a^2}}\right\}$ **(D)** $V=k\lambda\, ln\left\{\frac{a+L}{a}\right\}$

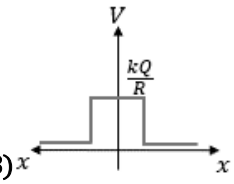
Q.8 The potential variation with distance for a uniformly charged ring having radius R and carrying charge Q is:

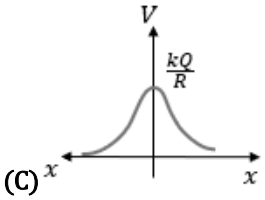


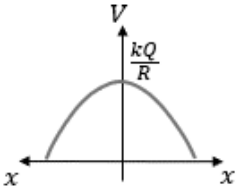
(A)



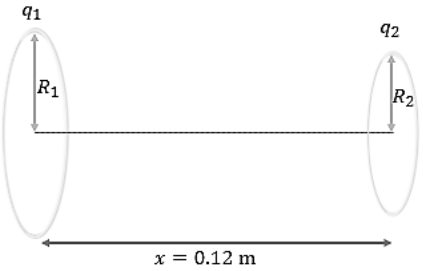
(B)



(C) 

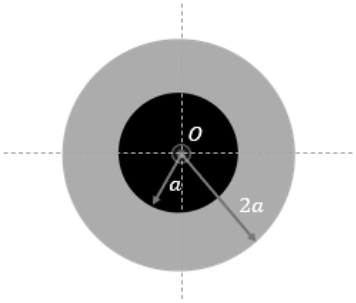
(D) 

Q.9 Two circular loops of radii 0.05 m and 0.09 m are arranged such that their axes coincide and their centres are 0.12 m apart. Charge of 10^{-6} C is spread uniformly on each loop. The potential difference between the centres of the loops is



(A) 64 kV **(B)** 71 kV **(C)** 82 kV **(D)** 95 kV

Q.10 An annular disc of inner radius a and outer radius $2a$ is uniformly charged with uniform surface charge density σ. Find the potential at a distance a from the centre at a point P lying on the axis which is perpendicular to the plane containing the disc.

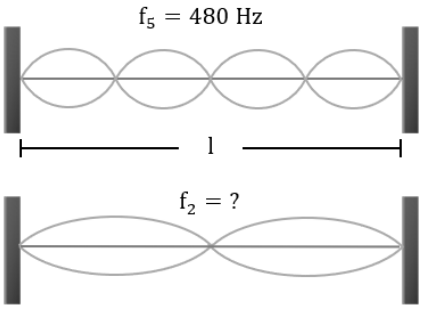


(A) $\frac{\sigma}{\epsilon_0}a(\sqrt{5}-\sqrt{2})$ **(B)** $\frac{\sigma}{2\epsilon_0}a(\sqrt{5}-\sqrt{2})$

(C) $\frac{\sigma}{2\epsilon_0}(\sqrt{3}-\sqrt{2})$ **(D)** $\frac{\sigma}{2\epsilon_0}a$

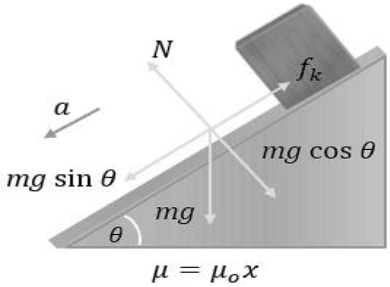
WORK SHEET

Q.1 A string vibrates in 5 segments to a frequency of 480 Hz. The frequency that will cause it to vibrate in 2 segments will be



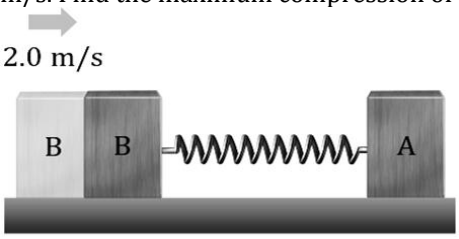
(A)96 Hz **(B)**96 Hz **(C)**96 Hz **(D)**96 Hz

Q.2 A small mass slides down an inclined plane of inclination θ with the horizontal. The coefficient of friction is $\mu = \mu_o x$ where the x is the distance through which the mass slides down and μ_o is a positive constant. Then the distance covered by the mass before it stops is



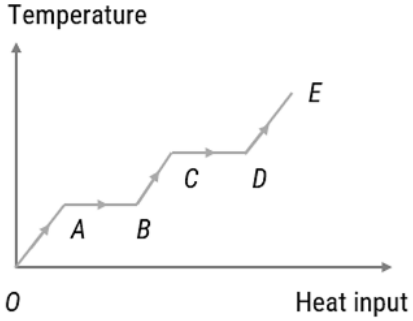
(A) $\frac{2}{\mu_o}\tan\theta$ **(B)** $\frac{4}{\mu_o}\tan\theta$ **(C)** $\frac{1}{2\mu_o}\tan\theta$ **(D)** $\frac{1}{\mu_o}\tan\theta$

Q.3 Two blocks A and B of equal mass $m = 1.0$ kg are lying on a smooth horizontal surface as shown in figure. A spring of force constant k = 200 N/m is fixed at one end of block A. Block B collides with block A with velocity $v_0 = 2.0$ m/s. Find the maximum compression of the spring.



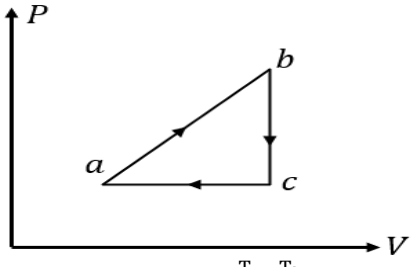
(A)10 Cm **(B)**5 Cm **(C)**15 Cm **(D)**20 Cm

Q.4 A solid material is being supplied heat at a constant rate. The temperature of material is changing with heat input as shown in the figure. What does the slope of DE represent?



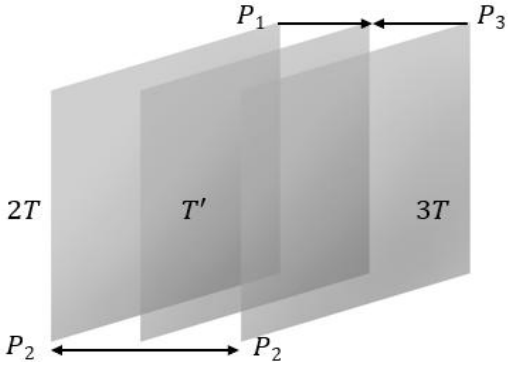
(A) Latent heat of liquid **(B)**Latent heat of vaporization
(C) Heat capacity of vapour **(D)**Inverse of heat capacity of vapour

Q.5 Figure illustrates a cycle conducted with n moles of an ideal gas. In the states a and b the gas temperatures are T_a and T_b respectively. Temperature of the gas in the state c is



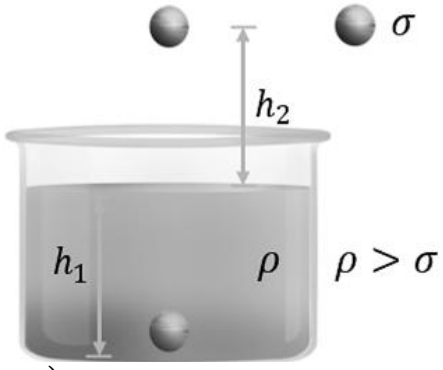
(A) $\sqrt{T_a T_b}$ **(B)** $T_a + T_b$ **(C)** $\frac{T_a - T_b}{T_a + T_b}$ **(D)** $\frac{(T_a + T_b)}{2}$

Q.6 Three very large plates of same area are kept parallel and close to each other. They are considered as ideal black surfaces and have very high thermal conductivity. The first and third plates are maintained at temperatures 2T and 3T respectively. The temperature of the middle (i.e., second) plate under steady state condition is:



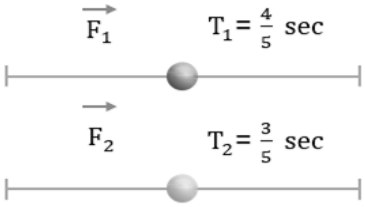
(A) $\left(\frac{65}{2}\right)^{\frac{1}{4}} T$ **(B)** $\left(\frac{97}{2}\right)^{\frac{1}{4}} T$ **(C)** $\left(\frac{97}{4}\right)^{\frac{1}{4}} T$ **(D)** $(97)^{\frac{1}{4}} T$

Q.7 A wooden ball of density σ is released from the bottom of a tank which is filled with a liquid of density ρ ($\rho > \sigma$) up to a height h_1. The ball rises in the liquid, emerges from its surface and attains a height h_2 in air. If viscous effects are neglected, the ratio $\frac{h_2}{h_1}$ is



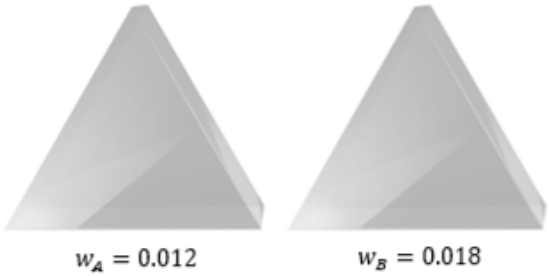
(A) $\left(\frac{\rho}{\sigma} + 1\right)$ **(B)** $\left(\frac{\rho}{\sigma} - 1\right)$ **(C)** $\frac{\rho}{\sigma}$ **(D)** $\frac{\sigma}{\rho}$

Q.8 Due to some force F_1, a body oscillates with period $\frac{4}{5}$ sec, and due to other force F_2, oscillates with period $\frac{3}{5}$ sec. If both forces act simultaneously, the new period will be:



(A)0.72 sec **(B)**0.64 sec **(C)**0.48 sec **(D)**0.36 sec

Q.9 Two prisms A and B have dispersive powers of 0.012 and 0.018 respectively. The two prisms are in contact with each other. The prism A produces a mean deviation of 1.2°, then the mean deviation produced by B if the combination produces deviation without dispersion is

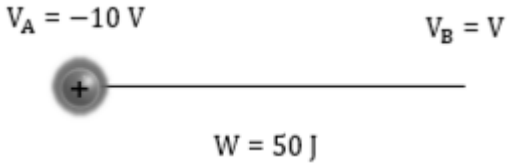


(A)3.6° **(B)**0.8° **(C)**0.4° **(D)**1.8°

Q.10 An equip-convex lens is made of glass of refractive index 1.5 and has a focal length 10 cm in air. The lens is cut into two equal halves along a plane perpendicular to its principal axis to yield two plano-convex lenses. If one of the plano-convex lenses is immersed in water the new focal length of it is $\left(\mu_w = \frac{4}{3}\right)$

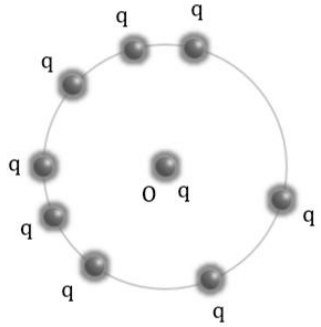
(A)40 cm **(B)**60 cm **(C)**80 cm **(D)**1000 cm

Q.11 It 50 J of work must be done to move an electric charge of 2 C from a point where potential is -10 V to another point where potential is 'V'. The value of V is



(A)-10 V **(B)**$+10$ V **(C)**$+15$ V **(D)**-15 V

Q.12 A point charge q is surrounded by eight fixed identical point charges at the same distance r as shown in figure. How much work will be done by external forces to move point charge q from centre O to infinity very slowly?



(A)$\frac{-2q^2}{\pi\epsilon_0 r}$ **(B)**$\frac{+2q^2}{\pi\epsilon_0 r}$ **(C)**0 **(D)**$\frac{-4q^2}{\pi\epsilon_0 r}$

Q.13 Two equal positive charges are kept at points A and B. The electric potential at the points between A and B (excluding the points A and B) is studied while moving from A to B. Then the electric potential will

(A)continuously increase **(B)**continuously decrease

(C)first increase and then decrease **(D)**first decrease and then increase

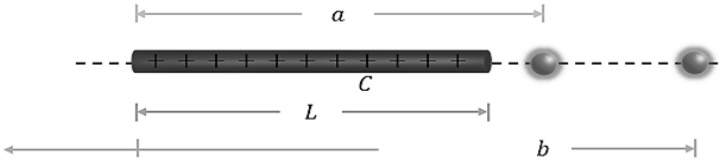
Q.14 Thee point charges $q_1 = 1\mu C$, $q_2 = -2\mu C$ and $q_3 = 3\mu C$ are placed at $(1m, 0, 0)$ and $(0, 2\ m)$ and $(0, 0, 3m)$ respectively. The electric potential at origin is

(A) $3\ x\ 10^3$ J/C **(B)** $9\ x\ 10^3$ J/C **(C)** $12\ x\ 10^3$ J/C **(D)** $15\ x\ 10^3$ J/C

Q.15 A point charge $q_1 = 2\ \mu C$ is placed at the origin of coordinates. A second charge, $q_2 = -3\ \mu C$, is placed on the $x-$ axis at $x = 100$ cm. For what positive $x-$coordinate of a point on the $x-$axis, the absolute potential at it is zero?

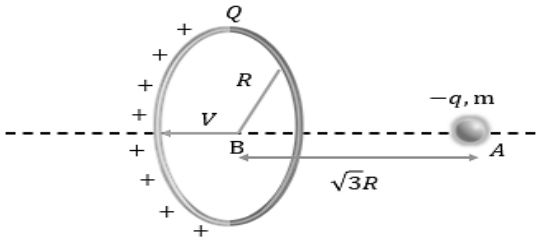
(A)10 cm **(B)**10 cm **(C)**10 cm **(D)**10 cm

Q.16 Two points are at a distance a and b apart $(a < b)$ from the left end of a uniformly charged rod as shown in the figure. The difference between the potentials at the two given points is proportional to



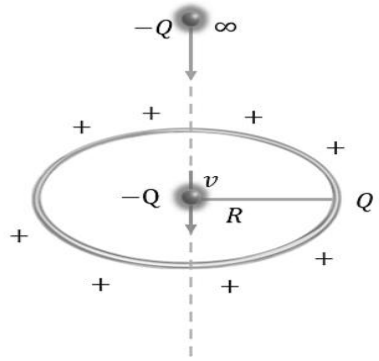
(A) $\frac{b}{a}$ **(B)** $\sqrt{\frac{b}{a}}$ **(C)** $\ln\left(\frac{b}{a}\right)$ **(D)** $\ln\left\{\frac{b(a-L)}{a(b-L)}\right\}$

Q.17 A point charge $-q$ of mass m is released with negligible speed from a distance $\sqrt{3}\,R$ on the axis of a fixed uniformly charged ring of charge Q and radius R. Find out the velocity of point charge when it reaches the centre of the ring.



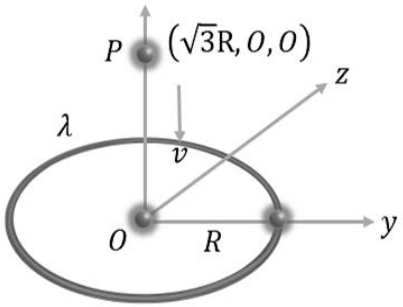
(A) $\sqrt{\frac{KQq}{2mR}}$ **(B)** $\sqrt{\frac{KQq}{mR}}$ **(C)** $\sqrt{\frac{2KQq}{mR}}$ **(D)** $\sqrt{\frac{KQq}{3mR}}$

Q.18 A charge +Q is uniformly distributed over a thin ring of radius R. Find the velocity of a negative point charge −Q at the moment it passes through the centre of the ring if it has mass m and was initially at rest at infinity on the axis of the ring.



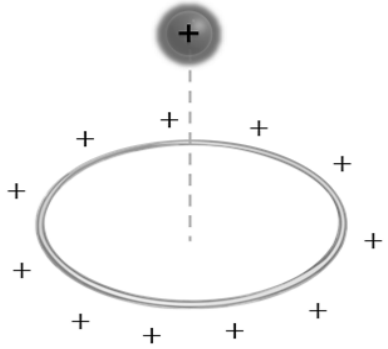
(A) $\sqrt{\frac{2kQ}{mR}}$ **(B)** $Q\sqrt{\frac{2k}{mR}}$ **(C)** $2Q\sqrt{\frac{k}{mR}}$ **(D)** 0

Q.19 A circular ring of radius R with uniform positive charge density λ is fixed in the $y-z$ plane with its centre at the origin O. A particle of mass m and charge $+q$ is projected from point $P(\sqrt{3}R, 0,0)$ on the positive x-axis directly towards O with initial velocity v such that the particle does not come back to P. The minimum value of v is



(A) $\sqrt{\frac{q\lambda}{\epsilon_0 m}}$ **(B)** $\sqrt{\frac{q\lambda}{2\epsilon_0 m}}$ **(C)** $\sqrt{\frac{2q\lambda}{\epsilon_0 m}}$ **(D)** $2\sqrt{\frac{q\lambda}{2\epsilon_0 m}}$

Q.20 A positively charged disc is placed on a horizontal plane. A charged particle is released from a certain height on its axis. The particle just reaches the centre of the disc then



(A) particle has a negative charge on it
(B) total potential energy (gravitational + electrostatic) first increases and then decreases
(C) total potential energy (gravitational + electrostatic) first decreases and then increases
(D) total potential energy (gravitational + electrostatic) decreases continuously

ANSWER KEY

Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(B)	(C)	(B)	(B)	(A)	(C)	(A)	(C)	(B)	(B)
WORK SHEET										
Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(B)	(A)	(A)	(D)	(A)	(C)	(B)	(C)	(B)	(C)
Q.	11	12	13	14	15	16	17	18	19	20
Sol.	(C)	(A)	(D)	(B)	(D)	(D)	(B)	(B)	(C)	(C)