# PHYSICS

# BOOKS - KVPY PREVIOUS YEAR

# MOCK TEST 8

## Exercise

**1.** Six point charges (each of magnitude Q) are placed on the six vertices of a cube of side x such that two adjacent vertices are vacant.

Electrostatic field intensity at the centre of the cube is $\left(k = \frac{1}{4\pi\varepsilon_0}\right)$

A. $\frac{4\sqrt{2}}{\sqrt{3}} \frac{kQ}{x^2}$

B. $\frac{8\sqrt{2}}{5\sqrt{3}} \frac{kQ}{x^2}$

C. $\frac{8\sqrt{2}}{3\sqrt{3}} \frac{kQ}{x^2}$

D. $\frac{4\sqrt{2}}{5\sqrt{3}} \frac{kQ}{x^2}$

**Answer:**

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**2.** A soap bubble of radius 'r' is blown up to form a bubble of radius 2r under isothemal conditions. If $\sigma$ be the surface tension of soap solution , the energy spent in doing so is

A. $3\pi\sigma r^2$

B. $6\pi\sigma r^2$

C. $12\pi\sigma r^2$

D. $24\pi\sigma r^2$

**Answer:**

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**3.** A ray of light is incident on a surface of glass slab at an angle $45^\circ$. If the lateral shift produced per unit thickness is $1/\sqrt{3}$, the angle of refraction produced is

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

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

C. $\sin^{-1}\left(1-\sqrt{\frac{2}{3}}\right)$

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

**Answer:**

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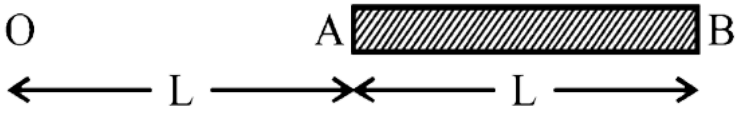
**4.** A charge Q is uniformly distributed over a long rod AB of length L as shown in the figure. The electric potential at the point O lying at distance L from the end A is



A. $\frac{Q}{8\pi\varepsilon_0 L}$

B. $\frac{3Q}{4\pi\varepsilon_0 L}$

C. $\frac{Q}{4\pi\varepsilon_0 L \ln 2}$

D. $\frac{Q \ln 2}{4\pi\varepsilon_0 L}$

**Answer:**

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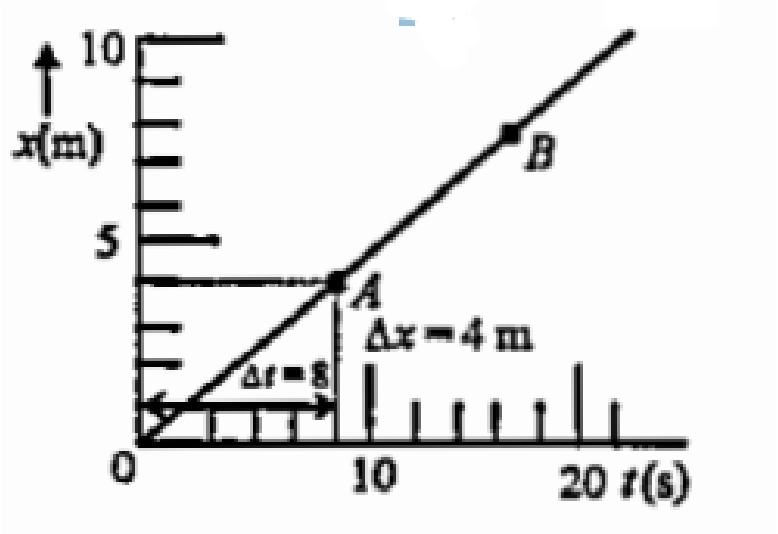
**5.** The graph of an object's motion (along the x-axis) is shown in the figure.The instantaneous velocity of the object at points

A and B are$v_A$ and $v_B$ respectively. Then




A. $v_A = v_B$= 0.5m/s

B. $v_A = 0.5m/s < v_B$

C. $v_A = 0.5m/s > v_B$

D. $v_A = v_B = 2m/s$

**Answer:**

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**6.** In an ideal YDSE when a glass plate ($\mu$=1.5) of thickness t is introduced in the path of one of the interfering beams the intensity at the position where the central maximum occured previously remains unchanged. The maximum thickness of the glass plate is:

A. $\lambda$

B. $\lambda/3$

C. $\frac{2\lambda}{3}$

D. $2\lambda$

**Answer:**

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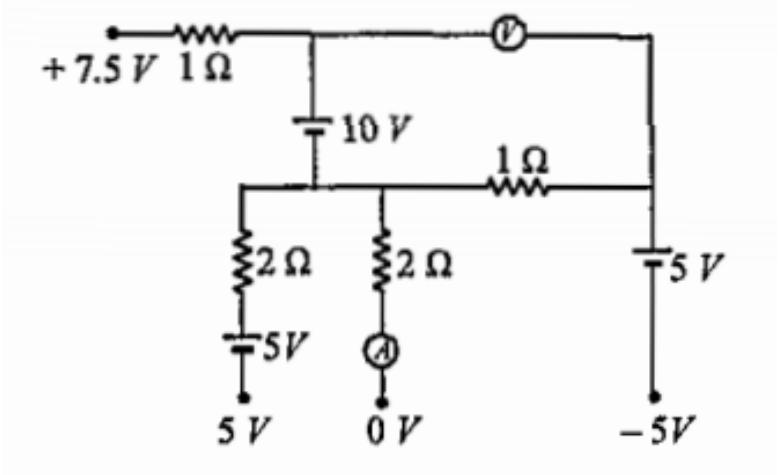
**7.** Potential of certain points in circuit are maintained as marked. What is reading of

voltmeter (If ammeter reads zero)?




A. 10V

B. 2.5V

C. 5V

D. 20V

**Answer:**

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**8.** If the wavelength of the first line of the Balmer series of hydrogen is $6561\text{Å}$, the wavelngth of the second line of the series should be

A. 13122 $\overset{\circ}{A}$

B. 3280 $\overset{\circ}{A}$

C. 4860$\overset{\circ}{A}$

D. 2187$\overset{\circ}{A}$

**Answer:**

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**9.** A bulb made of tungsten filament of surfece area 0.5 $cm^2$ is heated to a temperature 3000K when operated at 220V.The emissivity of the filament is $\in = 0.35$ and take $\sigma = 5.7 \times 10^{-8}$ mks units. Then the power of the bulb is,

A. 8.8W

B. 80.8 W

C. 0.88W

D. 800 W

**Answer:**

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**10.** A spherical small ball of density $\rho$ is gently released in a liquid of density $\sigma(\rho > \sigma)$.The initial acceleration of the free fell of the ball will be

A. $\left(\frac{\rho+\sigma}{\rho}\right).g$

B. $\left(\frac{\rho-\sigma}{\sigma}\right).g$

C. $\left(\frac{\rho-\sigma}{\rho}\right).g$

D. g

**Answer:**

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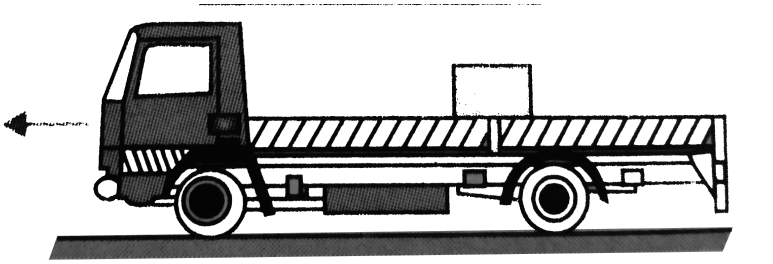
**11.** The rear side of a truck is open and a box of 40 kg mass is placed 5 m from the openend as shown The coefficient of friction between the

box and the surface below it is 0.15 On a straight road the truck starts from rest and accelerates with $2ms^{-2}$ At what distance from the starting point does the box fall off the truck ? (Ignore the size of the box )



A. 20m

B. 2m

C. 50m

D. 5m

**Answer:**

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**12.** $N$ atoms of a radioactive element emit $n$ alpha particles per second. The half-life of tge element is.

A. $\frac{n}{N}\sec$

B. $\frac{N}{n}\sec$

C. $\frac{0.693N}{n}\sec$

D. $\frac{0.693}{N}\sec$

**Answer:**

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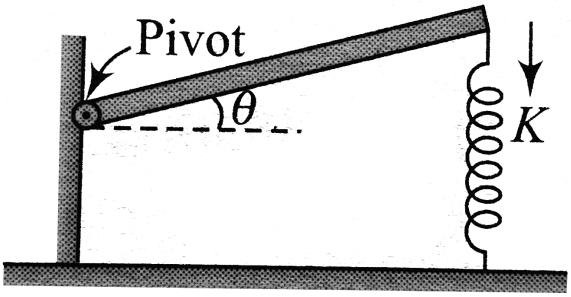


**13.**

A horizontal rod of mass m and length L is pivoted at one end The rod's other end is supported by a spring of force constant k. The rod is displaced by a small angle $\theta$ from its

horizontal equilibrium position and released. The angular frequency of the subsequent simple harmonic motion is

A. $\sqrt{\frac{3k}{m}}$

B. $srqt\left(\frac{k}{3m}\right)$

C. $\sqrt{\frac{3k}{m}+\frac{3g}{2L}}$

D. $\sqrt{\frac{k}{m}}$

**Answer:**

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**14.** Two simple pendulum of length $1m$ and $16m$ respectively are both given small displacement in the same direction at the same instant. They will be again in phase after the shorter pendulum has completed $n$ oscillations. The value of $n$ is

A. $\frac{1}{4}$ th oscillation

B. 4 oscillations

C. 5 oscillations

D. 16 oscillations

**Answer:**

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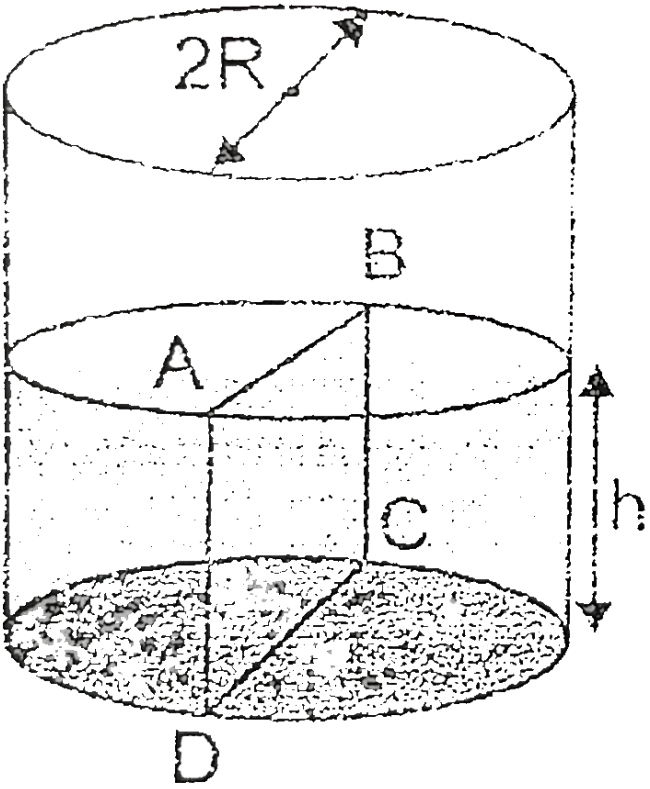
**15.** Water is filled up to a height $h$ in a beaker of radiys $R$ as shown in the figure. The density of water is $\rho$, the surface tension of water is $T$ and the atmospheric pressure is $P_0$. Consider a vertical section $ABCD$ of the water column through a diameter of the beaker. The force on water on one side on this section by water on

the other side of this section has magnitude




A. $\left|2P_0Rh + \pi R^2\rho gh - 2RT\right|$

B. $\left|2P_0Rh + R\rho gh^2 - 2RT\right|$

C. $\left|P_0\pi R^2 + R\rho gh^2 - 2RT\right|$

D. $\left|P_0\pi R^2 + R\rho gh^2 + 2RT\right|$

**Answer:**

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**16.** A police van moving on a highway with a speed of $30kmh^{-1}$ fires a bullet at a thiefs car speeding away in the same direction with a speed of $192kmh^{-1}$. If the muzzle speed of the bullet is $150ms^{-1}$ with what speed does the bullet hit the thiefs car ? (Note: Obtain

that speed which is relevant for damaging the thief s car).

A. 10 m/sec

B. 115m/sec

C. 105 m/sec

D. 15 m/sec

**Answer:**

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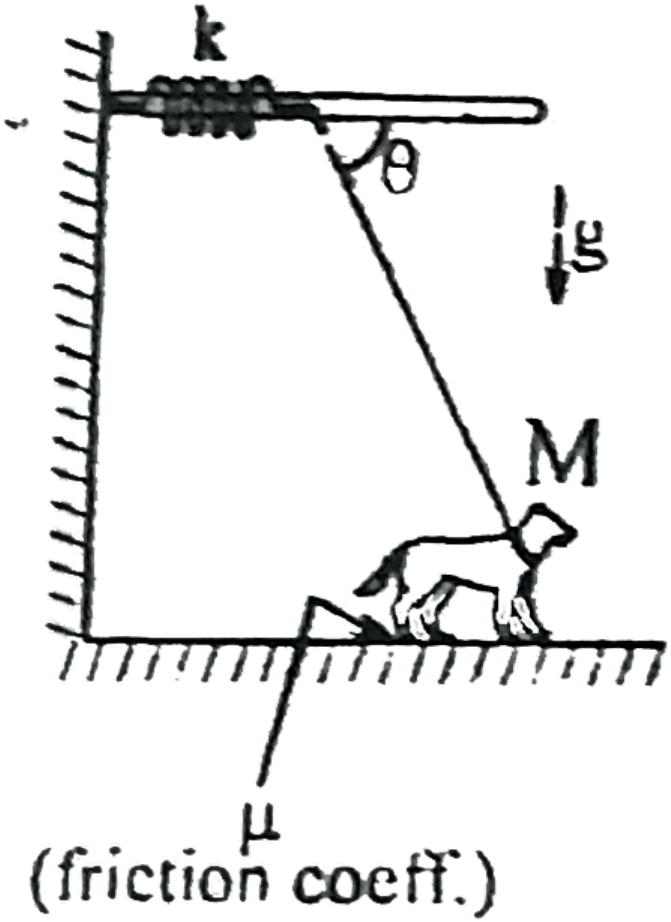
**17.** A dog with mass M has its string attached to one end of a spring which runs without friction along a horizontal overhead rod. The other end of the springs is fixed to a wall The spring constant is K. The string is massless and inextensible and it maintains a constant angle $\theta$ with the overhead rod, even when the dog moves. There is friction with coefficient mu between the dog and the gound What is the maximum distance (in cm) that the dog moving slowly can stretch the spring beyond its natural length? Use M=30 kg,

$K = 400N/m$ and $\mu = \frac{1}{3}$




A. 0.2m

B. 2m

C. 0.02m

D. 0.3m

**Answer:**

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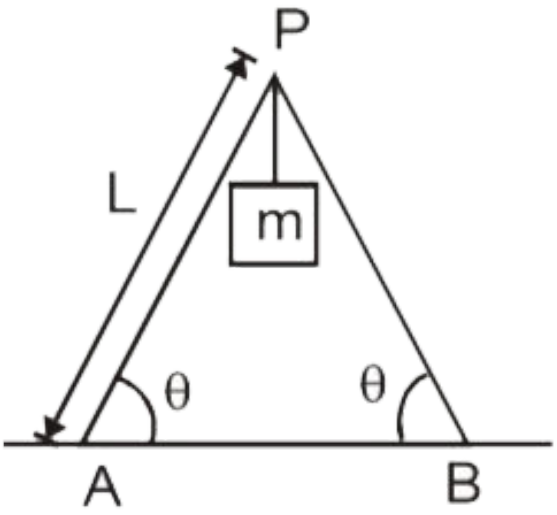
**18.** Two identical ladders, each of mass M and length L are resting on the rough horizontal surface as shown in the figure. A block of mass m hangs from P. If the system is in equilibrium, find the magnitude and the direction of

frictional force at A and B.




A. $\left[(M+m)\frac{g}{2}\right]\cot\theta$

B. $\left[(M-m)\frac{g}{2}\right]\cot\theta$

C. $\left[(M-m)\frac{g}{2}\right]\tan\theta$

D. $\left[(M+m)\frac{g}{2}\right]\tan\theta$

**Answer:**

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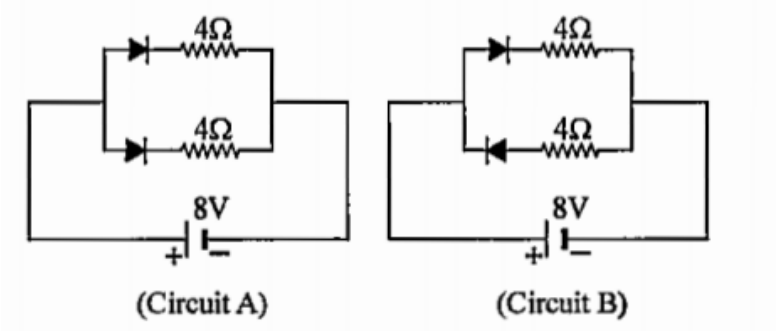
**19.** Currents flowing in each of the circuits A and B respectively are




A. 1A,2A

B. 2A,1A

C. 4A,2A

D. 2A,4A

**Answer:**

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**20.** The densitis of two solid spheres A and B of the same radii R very with radial distance $rasp_A(r) = k\left(\frac{r}{R}\right)$ and $p_B(r) = k\left(\frac{r}{(R)^5},\right.$ respectively, where k is a constant . The moments of inertia of the inividual spheres

about axes passing throgh their centres are $I_A$ and $I_B$ respectively. if $\frac{I_B}{I_A} = \frac{n}{10}$, the value of n is

A. 2

B. 5

C. 3

D. 6

**Answer:**

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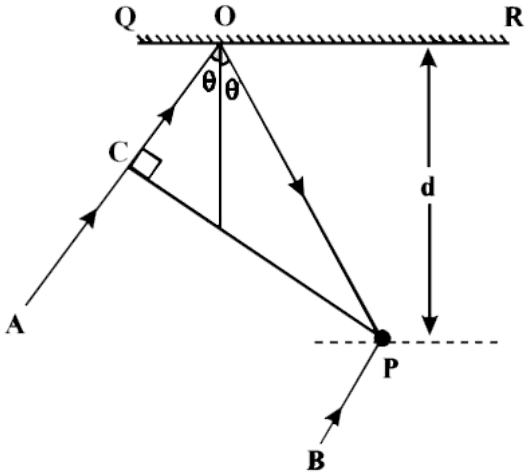
**21.** In the adjacent diagram, CP represents a wavefront and AO & BP, the corresponding two rays. Find the condition on $\theta$ for constructive interference at P between the ray BP and reflected ray OP.




A. $\cos\theta = 3\lambda/2d$

B. $\cos\theta = \lambda/4d$

C. $\sec\theta - \cos\theta = \lambda / d$

D. $\sec\theta - \cos\theta = 4\lambda / d$

**Answer:**

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**22.** Two solid cylinders P and Q of same mass and same radius start rolling down a fixed inclined plane from the same height at the same time. Cylinder P has most of its mass concentrated near its surface, while Q has

most its mass concentrated near the axis. Which statement(s) is (are) correct?

A. Both cylinders P and Q reach the ground at the sametime.

B. Cylinders P haslarger linear acceleration than cylinder Q.

C. Both cylinders reach the ground with same translationalkinetic energy.

D. Cylinder Q reachestheground with larger angular speed.

**Answer:**

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