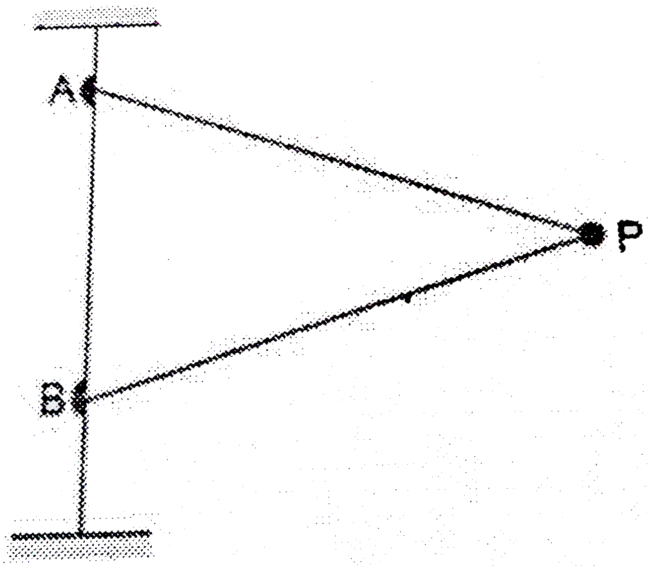
PHYSICS

BOOKS - D MUKHERJEE PHYSICS (HINGLISH)

MISCELLANEOUS QUESTION 3

Missellaneous Qns 3 Pragraph

1. The particle P of mass m is attached to two light, rigid rods AP and BP of length l each. A and B are hinges on a fixed vertical axis. The system APB can rotate freely about this axis. The angle ABP = the angle $BAP = \theta$. The tensions in AP and BP are T_1 and T_2 respectively.



When the system is at rest, which of the following is not correct?

A. At P, the direction of T_1 is from P to A.

B. At P, the direction of T_2 is from P to B.

C. The rods AP and BP together exert a net force and net torque on AB.

D. $T_1 = T_2$.

Answer: D

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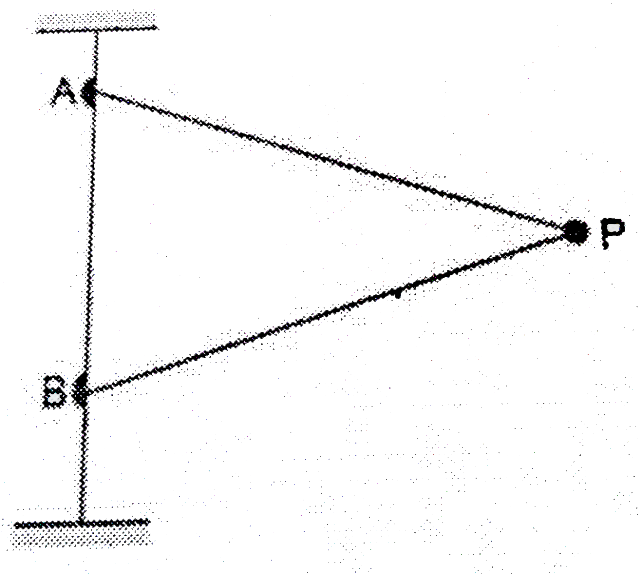
2. The particle P of mass m is attached to two light, rigid rods AP and BP of length l each. A and B are hings on a fixed vertical axis. The system APB can rotate freely about this axis. The angle ABP = the angle $BAP = \theta$. The tensions in AP and BP are T_1 and T_2 respectively.



When the system is made to rotate about AB with angular velocity ω, which of the following is not correct?

A. T_1 will always be greater than T_2.

B. $T_1 - T_2 = m\omega^2 t$ for small values of ω.

C. T_2 will become zero for $\omega^2 = g / l \cos \theta$.

D. The direction of T_2 will always be from P to B.

Answer: D

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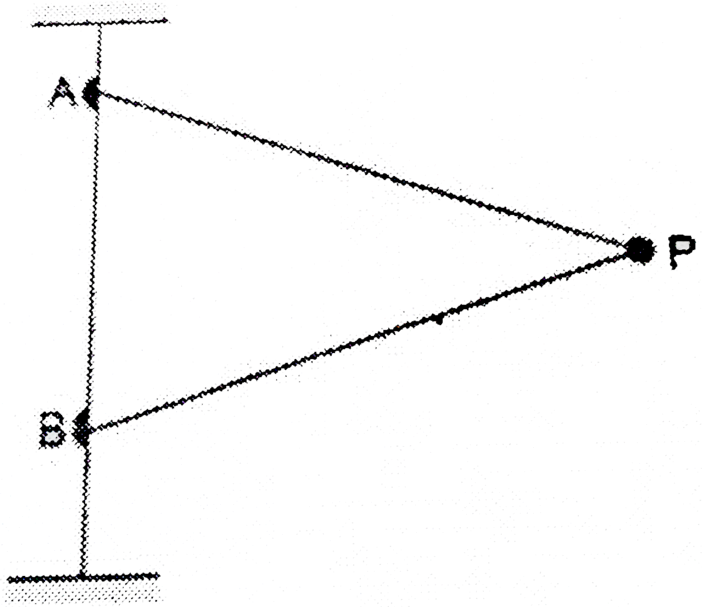
3. The particle P of mass m is attached to two light, rigid rods AP and BP of length l each. A and B are hings on a fixed vertical axis. The system APB can rotate freely about this axis. The angle ABP = the angle $BAP = \theta$. The tensions in AP and BP are T_1 and T_2 respectively.



The system is now rotated by 90° so that must be imparted to P, normal to the plane of the figure, such that it moves in a complete circular path in a vertical plane with AB as the axis?

A. $2\sqrt{gl\sin\theta}$

B. $2\sqrt{gl\cos\theta}$

C. $(5/2)\sqrt{gl\sin\theta}$

D. None of these

Answer: A

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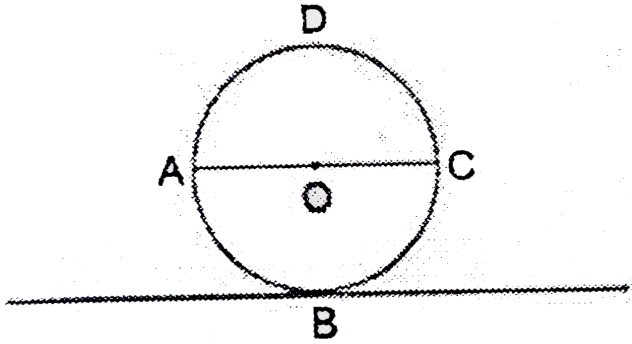
4. In a ring ABCD of radius r, the lower half ABC has mass m and the upper half ADC has mass $2m$. In both parts, the masses are distributed evenly. The ring is initially at rest on a horizontal surface, as shown. O is the centre of the ring.



Let C_1 denote the centre of mass of the section ABC and C_2 denote the centre of mass of the section ADC. The distance C_1C_2 is equal to

A. r

B. $2r / 3$

C. $2\pi r / 5$

D. $4r / \pi$

Answer: D

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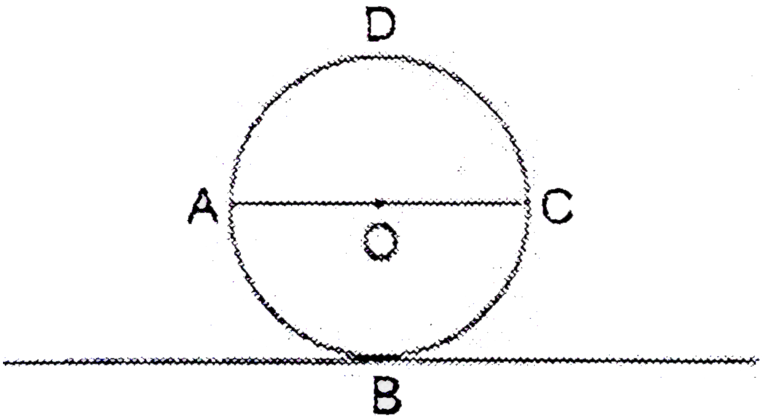
5. In a ring ABCD of radius r, the lower half ABC has mass m and the upper half ADC has mass $2m$. In both parts, the masses are distributed evenly. The ring is initially at rest on a horizontal surface, as shown. O is the centre of the ring.



The ring is now pushed very slightly and begins to roll on the horizontal surface without slipping. When it has made half a rotation, i.e., B is vertically above D, its angualar velocity ω will be given by (where $\beta = g/\pi r$)

A. $\omega^2 = 3\beta / 2$

B. $\omega^2 = 4\beta / 3$

C. $\omega^2 = 8\beta / 5$

D. $\omega^2 = 9\beta / 4$

Answer: C

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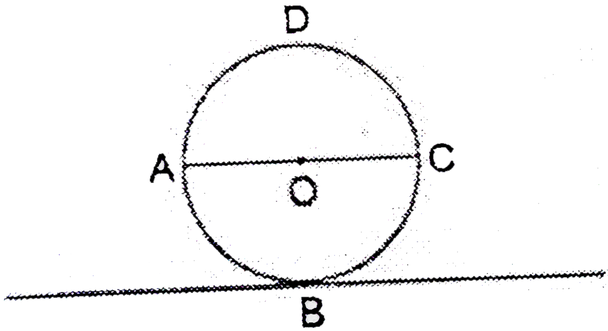
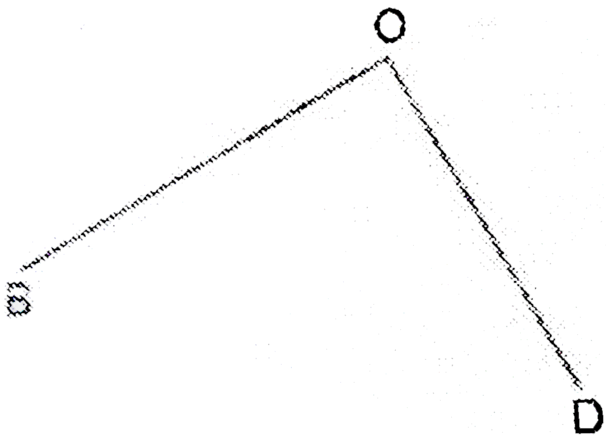
6. In a ring ABCD of radius r, the lower half ABC has mass m and the upper half ADC has mass $2m$. In both parts, the masses are distributed evenly. The ring is initially at rest on a horizontal surface, as shown. O is the centre of the ring.





The ring is now folded along the diameter AC, such that the plane of the section ABC is normal to the plane of the section ADC. (The angle BOD $= 90^{\circ}$). It is then placed on a thin, fixed horizontal wire, ie.e, the diameter AC lies along the wire. The angle made by DO with the vertical will now be

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

B. $\tan^{-1}(1/2)$

C. 30°

D. 60°

Answer: B

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7. A biconvex lens made of material with refractive index n_2. The radii of curvatures of its left surface and right surface are R_1 and R_2. The media on its left and right have refreactive indices n_1 and n_3 respectively. The first and second focal lengths of the lens are respectively f_1 and f_2.

The ratio, f_1 / f_2, of the two focal lengths is equal to

A. n_1 / n_3

B. $(n_1 - 1)/(n_3 - 1)$

C. $(n_1 + 1)/(n_3 + 1)$

D. $(n_2 - n_3)/(n_2 - n_1)$

Answer: A

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8. A biconvex lens made of material with refractive index n_2. The radii of curvatures of its left surface and right surface are R_1 and R_2. The media on its left and right have refreactive indices n_1 and n_3 respectively. The first and second focal lengths of the lens are respectively f_1 and f_2.

Assume that $n_1 = n_3$. Which of the following statements is not correct ?

A. $f_1 = f_2$.

B. f_3 is inversely proportional to $n_3 - 1$.

C. If R_1 and R_2 are unequal, the focal length would depend on the direction in which light travels through the lens.

D. f_1 may be negative if $n_1 > n_2$.

Answer: C

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9. A biconvex lens made of material with refractive index n_2. The radii of curvatures of its left surface and right surface are R_1 and R_2. The media on its left and right have refreactive indices n_1 and n_3 respectively. The first and second focal lengths of the lens are respectively f_1 and f_2.

Assume that $R_1 = R_2, n_1 \neq n_3$. The ratio, f_1 / f_2, of the two focal lengths is equal to

A. 1

B. n_1 / n_3

C. n_3 / n_1

D. $(n_3 - 1) / (n_1 - 1)$

Answer: B

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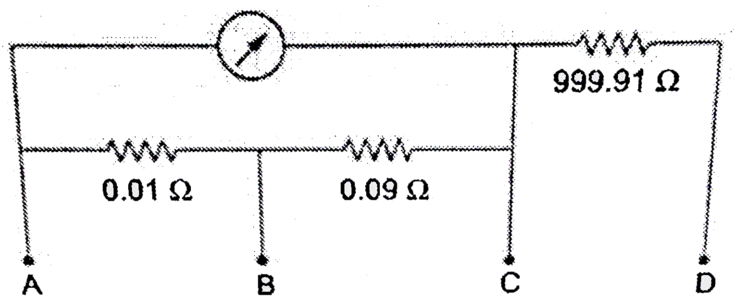
10. Electrical multimeters, or multitesters, are widely used by technicians when working with electrical and electronic circuits. In this instrument, a single milliammeter connected through different resistances is used to measure currents, potential differences and resistance over different ranges.

Current always enters the multimeter at the same terminal, A, and then passes through the milliammeter as well as through other resistances, placed in series with or parallel to it. The choice of the terminal at which current leaves the instrument decides its role (ammeter, voltemeter, etc.) and its range (maximum current or voltage which it can measure).

The milliammeter shown in the circuit has a coil (or internal) resistance of 0.9ω and gives the full-scale deflection for a current of $10mA$.



If A and B are used as the terminals of the multimeter, i.e., current enters at A and leaves at B, it will function as an ammeter of range

A. $10A$

B. $1A$

C. $100mA$

D. $10mA$

Answer: B

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11. Electrical multimeters, or multitesters, are widely used by technicians when working with electrical and electronic circuits. In this instrument, a single milliammeter connected through different resistances is used to measure currents, potential differences and resistance over different ranges.

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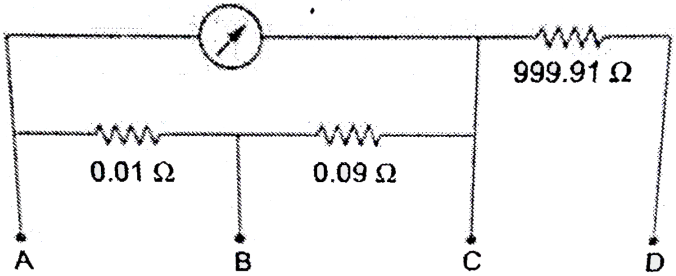

If A and C are used as the terminals of the multimeter, i.e., current enters at A and leaves at C, it will function as an ammeter of range

A. $10A$

B. $1A$

C. $100mA$

D. $10mA$

Answer: C

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12. Electrical multimeters, or multitesters, are widely used by technicians when working with electrical and electronic circuits. In this instrument, a single milliammeter connected through different resistances is used to measure currents, potential differences and resistance over different ranges.

Current always enters the multimeter at the same terminal, A, and then passes through the milliammeter as well as through other resistances, placed in series with or parallel to it. The choice of the terminal at which current leaves the instrument decides its role (ammeter, voltemeter, etc.) and its range (maximum current or voltage which it can measure).

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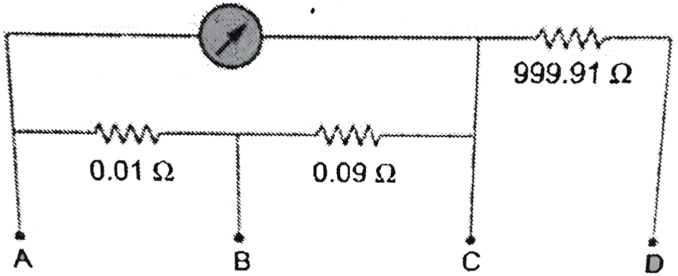

If A and D are used as the terminals of the multimeter , i.e., current eneters at A and leaves at D, it will function as a voltmeter of which range?

A. $1V$

B. $10V$

C. $100V$

D. It will not function either as a voltmeter or as an ammeter or a milliammeter.

Answer: C

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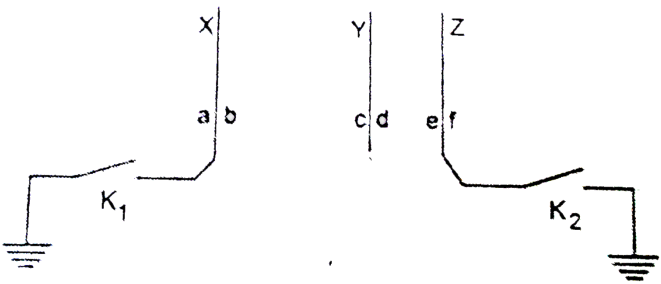
13. 

The figure shows three identical parallel conducting plates X, Y and Z. The separation

between X and Y is 2d, and that between Y and Z is d. The six surfaces of the three plates are labeled a,b,c,d,e and f, as shown. The key K_1 can connect X to ground,and the key K_2 can connet Z to ground. Initially, both keys are open. Y has Q charge, X and Z have no charge. If K_1 is closed and K_2 remains open, the charges on the surfaces a,b,c,d,e and f will be respectively.

A. $0, \ -Q, Q, 0, 0$ and 0

B. $0, \ -Q/2, Q/2, Q/2$ and 0

C. $0, \ -Q/3, Q/3, 2Q/3, \ -2Q/3$ and 0

D. $-Q/3, Q/3, 2Q/3, \; -2Q/3, \; -Q/3$

and $Q/3$

Answer: A

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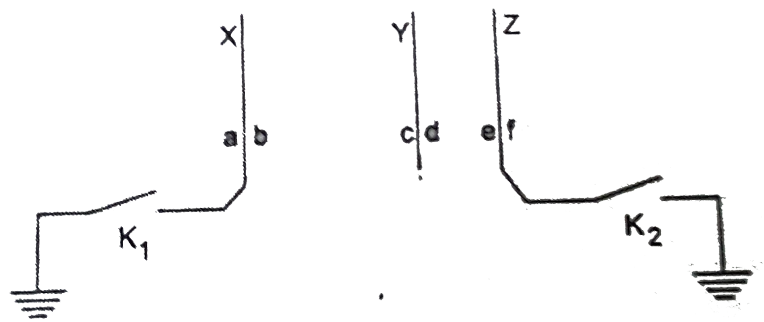
14. 

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A. $0, 0, 0, Q, -Q$ and 0

B. $0, -Q/3, Q/3, 2Q/3, -2Q/3$ and 0

C. $0, -2Q/3, 2Q/3, Q/3, -Q/3$ and 0

D. $-Q/3, Q/3, Q/3, 2Q/3, -Q/3$ and $Q/3$

Answer: A

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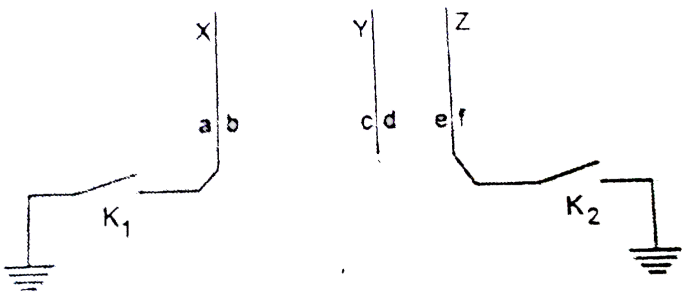
15. 

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A. $0, Q, -Q, 0, 0$ and 0

B. $0, 0, 0, Q, -Q$ and 0

C. $0, -2Q/3, 2Q/3, Q/3, -Q/3$ and 0

D. $0, \ -Q/3, Q/3, 2Q/3, \ -2Q/3$ and 0

Answer: D

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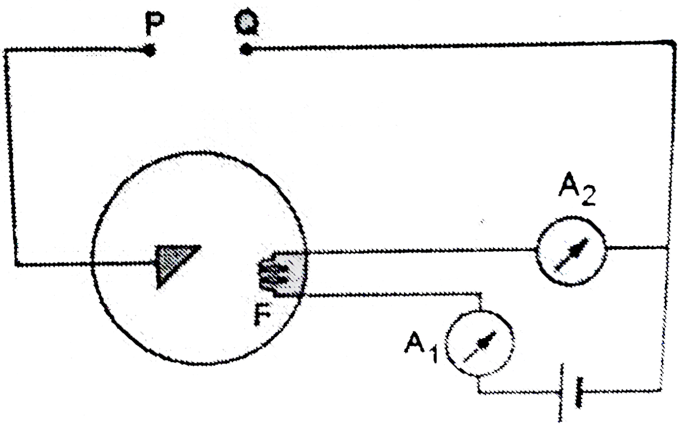
16. 

The diagram shows the basic setup for the production of X-rays. A_1 and A_2 are two ammeters, reading $2.55A$ and $2.566A$ respectively. F is a filament which is alos the cathode. The potential difference applied between P and Q is $50000V$. Assume that all X-rays photons have the maximum possible energy and that one X-ray photon is emitted for every 100 electron incident on the target. You may assume that the kinetic energy of other electrons reappear as heat in the tube. The number of X-ray photons produced per second is approximately

A. 10^{12}

B. 10^{15}

C. 10^{18}

D. 10^{21}

Answer: B

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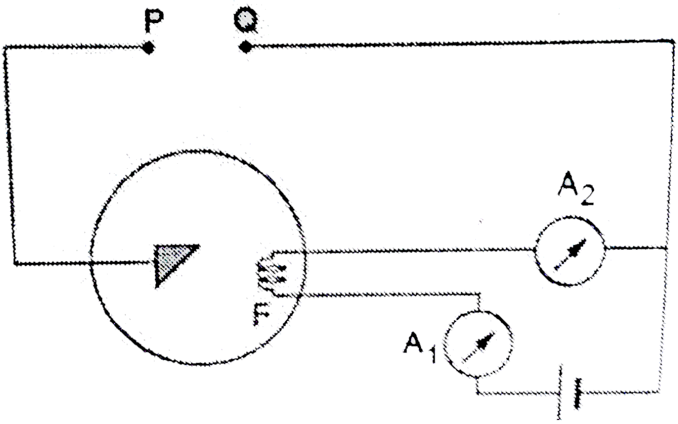
17.



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A. $3 \times 10^{-17} kgms^{-1}$

B. $3 \times 10^{-20} kgms^{-1}$

C. $3 \times 10^{-23} kgms^{-1}$

D. $3 \times 10^{-26} kgms^{-1}$

Answer: C

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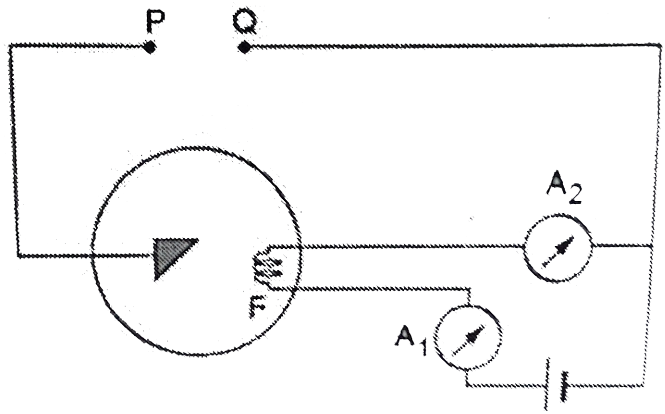
18. 

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A. $10W$

B. $40W$

C. $200W$

D. $800W$

Answer: D

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