PHYSICS

BOOKS - SARAS PUBLICATION

WORK, ENERGY AND POWER

Example

1. If Q, E and W denote respectively the heat added, change in internal energy and the work done in a closed cyclic process, then ..... .

A. W=0

B. Q=W=0

C. E=0

D. Q=0

Answer:

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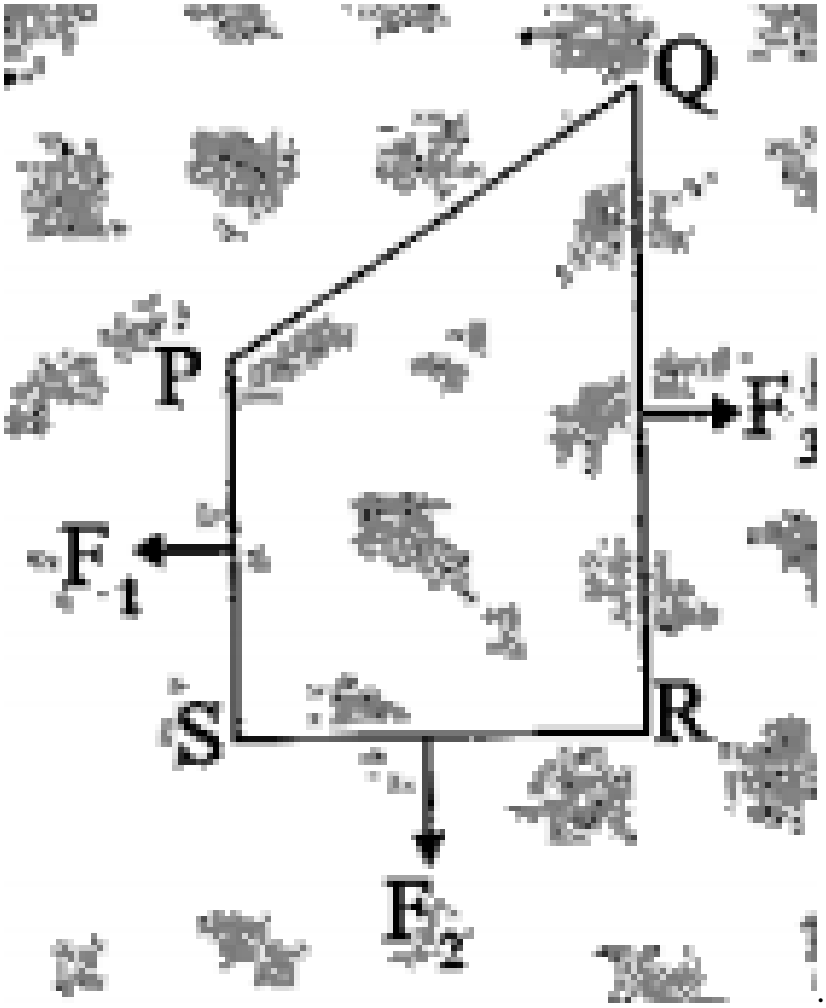
2. A closet loop PQRS carrying a current is placed in a uniform magnetic field. If the magnetic forces on segments PS,SR and RQ are F_1, $F_2$and F_3 respectively and are in the plane of the paper and along the directions

shown, the force on the segment QP is:



A. $F_3 - F_1 - F_2$

B. $\sqrt{(F_3 - F_1)^2 + F_2^2}$

C. $\sqrt{(F_3 - F_1)^2 - F_2^2}$

D. $F_3 - F_1 - F_2$

Answer:

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3. An electric kettle takes 4A current at 220V . How much time will it take to boil 1 Kg of water from temperature 20° ? The temperature of boiling water is $100^\circ C$.

A. 6.3min

B. 8.4min

C. 12.6min

D. 4.2min

Answer:

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4. A particle moves in a straight line with a constant acceleration. It changes its velocity from $10ms^{-1}$ to $20ms^{-1}$ while passing through a distance 135m in t second. The value of t is:

A. 10

B. 1.8

C. 12

D. 9

Answer:

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5. If F is the force acting on a particle having position vector $\vec{r}$ and $\vec{\tau}$ be the torque of this force about the origin , then,

A. $\vec{r}.\vec{\tau} > 0$ and $\vec{F}.Vec\tau < 0$

B. $\vec{r}.\vec{\tau} = 0$ and $\vec{F}.Vec\tau = 0$

C. $\overrightarrow{r} . Vec\tau = 0$ and $\overrightarrow{F} . \overrightarrow{\tau} \neq 0$

D. $\overrightarrow{r} . \overrightarrow{\tau} \neq 0$ and $\overrightarrow{f} . Vec\tau = 0$

Answer:

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6. The internal energy change in a system that has absorbed $2\ kcal$ of heat and done $500\ J$ of work is

A. 6400J

B. 5400J

C. 7900J

D. 8900J

Answer:

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7. A source S_1 is producing 10^{15}photons per second of wavelength$5000\overset{\circ}{A}$ .Another source S_2 is producing 1.02×10^{15}, photon per second of wavelength $5100\overset{\circ}{A}$. Then (power of S_2) (power of S_1)is equal to:

A. 1

B. 1.02

C. 1.04

D. 0.98

Answer:

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8. Two positive ions , each carrying a charge q, are separated by a distance d. If F is the force of repulsion between the ions,the number of electrons missing from each ion will be (e being the charge on an electron).

A. $\frac{4\pi\varepsilon_0 F d^2}{e^2}$

B. $\sqrt{\frac{4\pi\varepsilon_0 Fe^2}{d^2}}$

C. $\sqrt{\frac{4\pi\varepsilon_0 Fd^2}{e^2}}$

D. $\frac{4\pi\varepsilon_0 Fd^2}{q^2}\Big)$

Answer:

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9. A body of mass M hits normally a rigid wall with velocity V and bounces back with the same velocity . The impulse experienced by the body is:

A. zero

B. MV

C. 1.5 MV

D. 2MV

Answer:

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10. The potential energy of a system increases, if work is done

A. Upon the system by a conservative force

B. Upon the system by a non conservative force

C. By the system against a conservative force

D. By the system against a non - conservative force

Answer:

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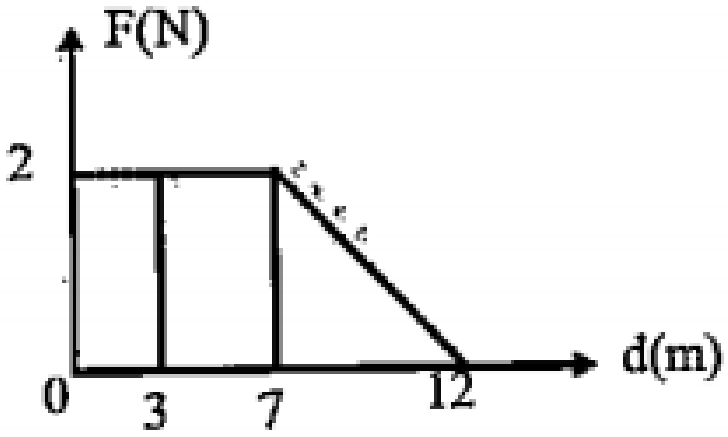
11. Force F on a particle moving in a straight line varies with distanced d as shown in the figure. The work done on the particle during its

displacement of 12m is:



A. 13J

B. 18J

C. 21J

D. 26J

Answer:

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12. The power obtained in a reactor using U235 disintegration is 1000 Kw.

The mass decay of U235 per hour is:

A. 1 microgram

B. 10 microgram

C. 20 microgram

D. 40 microgram

Answer:

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13. If the radius of a star is R and it acts as a block body . What would be the temperature of the star, in which the rate of energy production is Q?

A. $\left(Q / 4\pi R^2 \sigma\right)^{-1/2}$

B. `(4 pi R^2Q//sigma)^(-1//2)

C. $\left(Q / 4\pi R^2 \sigma\right)^{1/4}$

D. $Q / 4\pi R^2)\sigma$

Answer:

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14. A body of mass m falls from earth's surface at a height equal to twice the radius (R) each. Then the change in P.E. of body will be

A. $mg2R$

B. $\frac{2}{3}mgR$

C. $3mgR$

D. $\frac{1}{3}mgR$

Answer:

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15. A person holdinga rifle (mass of person and rifle together is 100kg) stands on a smooth surface and fires 10 shots horizontally, in5s. Each bullet has a mass of 10 g with a muzzle velocity of `800 ms^(-1).The final

velocity acquired the person and the average force exerted on the person are:

A. $-1.6ms^{-1}, 8N$

B. $-0.08ms^{-1}, 16N$

C. $-0.8ms^{-1}, 16N$

D. $-1.6ms^{-1}, 16N$

Answer:

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16. One coolie takes 1 minute to raise a suitcase through a height of 2m but the second coolie takes 30 s to raise the same suitcase to the same height. The powers of two coolies are in the ratio':

A. $1:2$

B. $1:3$

C. $2:1$

D. $3:1$

Answer:

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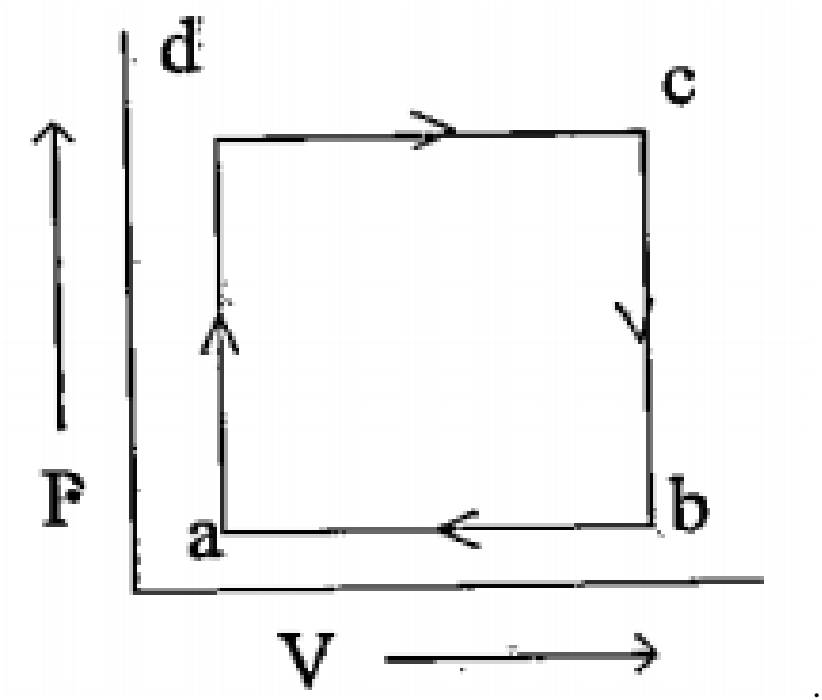
17. A system is taken from state a to state c by two paths adc and abc as shown in the figure. The internal energy at a is $U_a = 10J$.Along the path adc the amount of heat absorbed $\delta Q_1 = 50J$ and the work obtained $\delta W_1 = 20J$whereas along the path abc the heat absorbed $\delta Q_2 = 36J$

The amount of work along the path abc is :



A. 6 J

B. 10J

C. 12J

D. 36J

Answer:

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18. A projectile is fired from the surface of the earth with a velocity of $5ms^{-1}$ and angle θ with the horizontal. Another projectile fired from another planet with a with a velocity of$3ms^{-1}$ at the same angle follows a trajectory of the projectile fired from the earth . The value of the acceleration due to gravity on planet is $(\in ms^{-2}$ is $(giveng = 9.8ms^{-2}.$

A. 3.5

B. 5.9

C. 16.3

D. 110.8

Answer:

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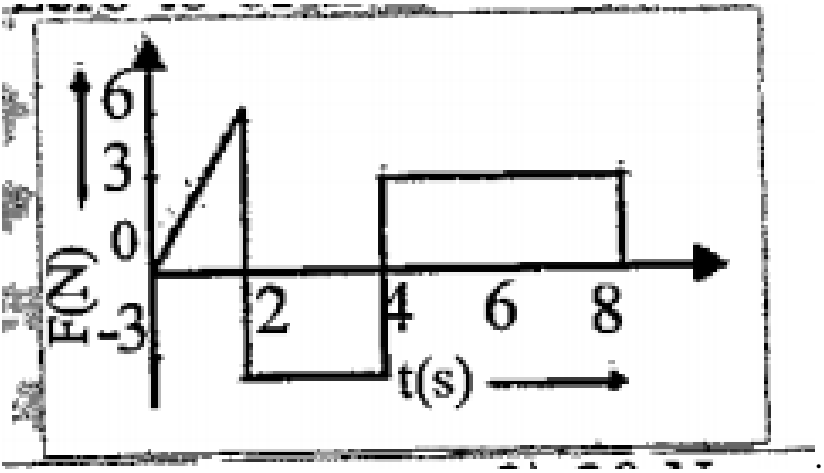
19. The force F acting on a particle of mass m is indicated by the force time graph shown below. The change in momentum of the particle over

the time interval from zero to 8s is:



A. 24Ns

B. 20Ns

C. 12Ns

D. 6Ns

Answer:

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20. A body of mass 4 m is lying in xy - plane at rest. It suddenly explodes into three pieces. Two pieces each of mass m move perpendicular to each

other with equal speed v. The total kinetic energy generated due to explosion is

A. mv^2

B. $\frac{3}{2}(mv^2)$

C. smv^2

D. $4mv^2$

Answer:

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21. A force $\vec{F} = \alpha\hat{i} + 3\hat{j} + 6\hat{k}$ is acting at a point $\vec{r} = 2\hat{i} - 6\hat{j} - 12\hat{k}$ .The value of α for which angular momentum about origin is conserved is:

A. 1

B. -1

C. 2

D. zero

Answer:

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22. Two particles A and B, move with constant velocities, $\vec{v}_1$ and $\vec{v}_2$. At the initial momentum their position vectors are $\vec{r}_1$ and $\vec{r}_2$ respectively. The condition for particle A and B for their collision is:

A. $r_1 - r_2 = v_1 - v_2$

B. $\frac{\vec{r}_1 - \vec{r}_2}{\left|\vec{r}_1 - \vec{r}_2\right|} = \frac{\vec{v}_2 - \vec{v}_1}{\left|\vec{v}_2 - \vec{v}_1\right|}$

C. $r_1 . v_1 = r_2 . v_2$

D. $r_1 \frac{6}{5} v_1 = r_2 \times v_2$

Answer:

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23. On a frictionless surface a block of mass. M moving at a speed v collides elastically with another block of same mass M which is initially at rest. After collision the first block moves at an angle θ to its initial direction and has a speed $\frac{v}{3}$. The second block's speed after the collision is :

A. $\frac{\sqrt{3}}{2}$

B. $\frac{2\sqrt{2}}{3}$

C. $\frac{3}{4}$

D. $\frac{3}{\sqrt{2}}$

Answer:

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24. A block A of mass m_1 rests on a horizontal table . A light string connected to it passes over a frictionless pulley at the edge of table and from its other end another block B of mass m_2 is suspended . The

coefficient of kinetic friction between the block and the table is μ. When the block A is sliding on the table the tension in the string is :

A. $((m_2 - \mu_k m_1)g)\dfrac{)}{m_1 + m_2}$

B. $\dfrac{m_1 m_2(1 + \mu_k)g}{m_1 + m_2}$

C. $(m_1 m_2 1 - \mu_k)g\dfrac{)}{m_1 + m_2}$

D. $\dfrac{(m_2 + \mu_k m_1)g}{m_1 + m_2}$

Answer:

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25. Two particles of masses m_1, m_2$movewith\int ialvelocity$mu_1 and mu_2

. $Oncollision, o \neq ofthepartic \leq s \geq texcited \rightarrow higher \leq vel, after|$ or epsilon. $Iff \in alvelocitiesofpartic \leq sbe$v_1 and v_2` then we must have:

A. $\dfrac{1}{2}m_1 u_1^2 + \dfrac{1}{2}m_2 u_2^2 = \dfrac{1}{2}m_1 v_1^2 + \dfrac{1}{2}m_2 v_2^2 - \varepsilon$

B. $\frac{1}{2}m_1u_1^2+\frac{1}{2}m_2u_2^2-\varepsilon=\frac{1}{2}m_1v_1^2+\frac{1}{2}m_2v_2^2$

C. $\frac{1}{2}m_1u_1^2+\frac{1}{2}m_2u_2^2+\varepsilon=\frac{1}{2}m_1v_1^2+\frac{1}{2}m_2v_2^2$

D. $m_1^2u_1+\frac{1}{2}m_2^2u_2-\varepsilon=m_1^2v_1+m_2^1v_1+m_2^2v_2$

Answer:

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26. A wind with speed 40 m/s blows parallel to the roof of a house. The area of the roof is 250 m^2. Assuming that the pressure inside the house is atmospheric pressure, the force exerted by the wind on the roof and the direction of the force will be: $\left(\rho_{\text{air}}=1.2kg/m^3\right)$

A. $4.8\times10^5N,\ upwards$

B. $2.4\times10^5N,\ upwards$

C. $2.4\times10^5N,\ downwards$

D. $4.8\times10^5N,\ downwards$

Answer:

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27. Three blocks A, B and C of mass 4 kg , 2kg and 1kg respectively , are in contact on frictionless surface as shown .If a force appliedon 14N is applied on the 4 kg block then the contact force between A and B is :

A. 6N

B. 8N

C. 18N

D. 2N

Answer:

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28. A particle mass m is driven by a machine that delivers a constant power K watts . If the particle starts from rest the force on the particle at time t is:

A. $\sqrt{mk}t^{-\frac{1}{2}}$

B. $\sqrt{2mk}t^{-\frac{1}{2}}$

C. $a\frac{1}{2}\sqrt{mk}t^{-\frac{1}{2}}$

D. $\sqrt{m\frac{k}{2}}t^{-\frac{1}{2}}$

Answer:

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29. A particle moves so that its position vector is given by $\overrightarrow{r} = \cos\omega t\hat{x} + \sin\omega t\hat{y}$. Where $\omega$is a constant . Which of the following is true?

A. Velocity is perpendicular to $\vec{r}$ and acceleration is directed away from the origin.

B. Velocity and acceleration both are perpendicidar to $\vec{r}$

C. Velocity and acceleration both are parallel to $\vec{r}$

D. Velocity is perpendicular to $\vec{r}$ and acceleration is directed towards the origin

Answer:

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30. A refrigerator works between $4^{\circ}C$ and 30° , it is required to remove 600 calories of heat every second in order to keep the temperature of the refrigetor space constant. The power required is :(Take1 cal = 4.2 joules).

A. 2365W

B. 2.365W

C. 23.65W

D. 236.5W

Answer:

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31. A body of mass 1kg begins to more under the action of a time dependent force $F = \left(2t\hat{i} + 3t^2\hat{j}\right)N$ where $\hat{i}$ and $\hat{j}$ are unit vectors along x and y axes. What power will be developed by a force at time t?

A. $\left(2t^3 + 3t^5\right)W$

B. $\left(2t^2 + 3t^3\right)W$

C. $\left(2t^2 + 3t^4\right)W$

D. $\left(2t^3 + 3t^4\right)W$

Answer:

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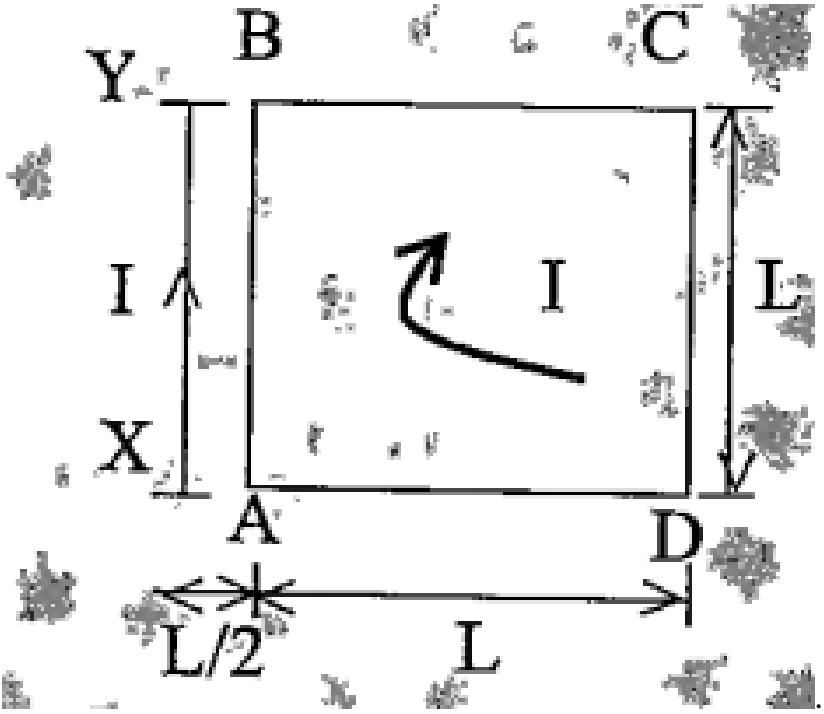
32. A square ABCD carrying a current I, is placed near and coplanar XY carrying a current I, the net force on the loop will be:



A. $\frac{\mu_0 liL}{2}\pi$

B. $\frac{2\mu_0 li}{3}\pi$

C. $\frac{\mu_0 li}{2}\pi$

D. $\frac{2\mu_0 liL}{3}\pi$

Answer:

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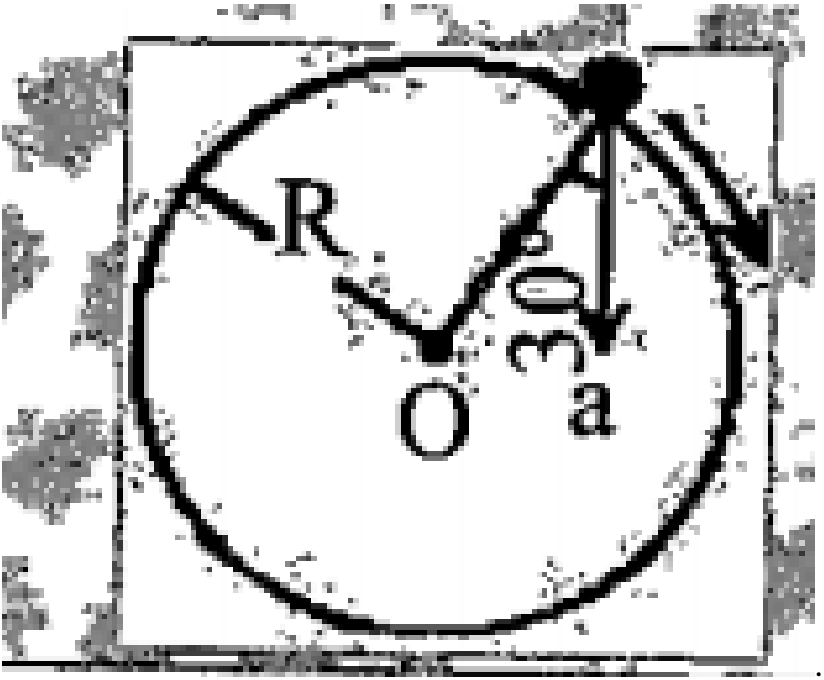
33. In the given figure , $a = 15m/s^2$ represent the total acceleration of a particle moving in the clockwise direction in a circle of radius R=2.5m at a given instant of time . The speed of the particle is ,



A. $5.7m/s$

B. $6.2m/s$

C. $4.5m/s$

D. $5.0m/s$

Answer:

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34. Two identical balls A and B having velocities of $0.5M/s$ and $-0.3m/s$ respectively collide elasticity in one dimension. The velocities of B and A after the collision respectively will be:

A. $-0.3m/s$ and $0.5m/s$

B. $0.3m/s$ and $0.5m/s$

C. $-0.5m/s$ and $0.3m/s$

D. $0.5m/s$ and $-0.3m/s$

Answer:

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35. A particle moves from a point $\left(-2\hat{i}+5\hat{j}\right)$ to $\left(4\hat{j}+3\overrightarrow{k}\right)$ when a force of $\left(4\hat{i}+3\hat{j}\right)$N is applied . How much work has been done by the force?

A. 5J

B. 2J

C. 8J

D. 11J

Answer:

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36. A spring of force constant k is cut into the length of ratio $1:2:3$. They are connected in series and the new force constant is k' . Then they are connected in parallel and force constant is k",. Then k':k":

A. $1:9$

B. $1:11$

C. $1:14$

D. $1:16$

Answer:

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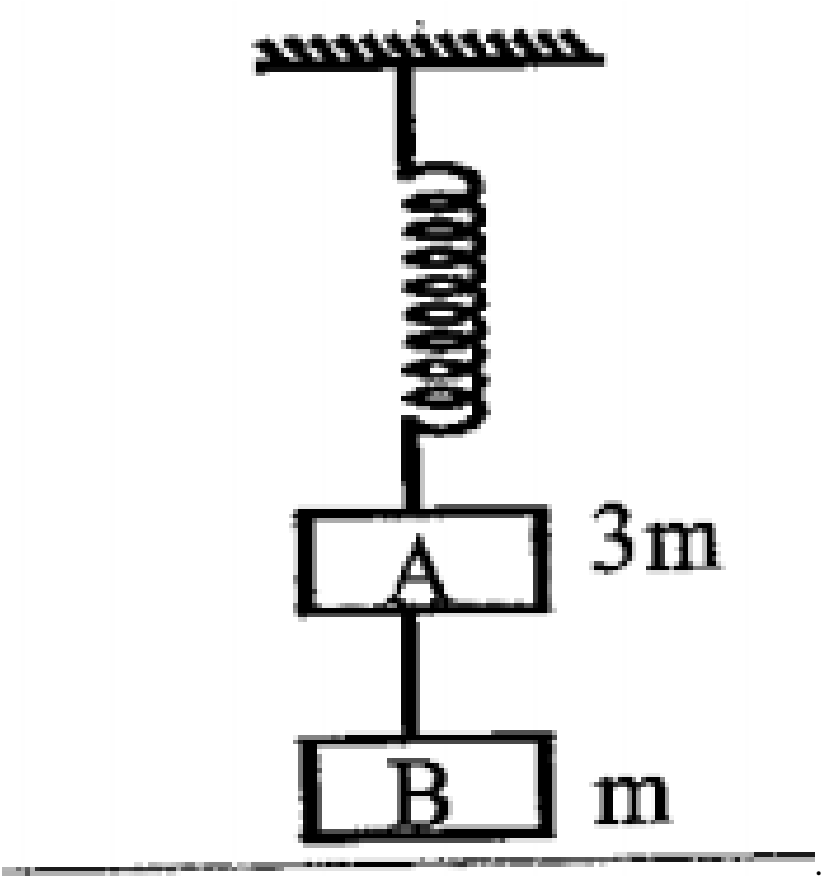
37. Two blocks A and B masses 3m and m respectively are connected by a massless and inextensible string.The whole system is suspended by a massless spring as shown in figure . The magnitudes of acceleration A

and B immediately after the string is cut , are respectively:



A. $\frac{g}{3}, g$

B. g,g

C. $\frac{g}{3}, \frac{g}{3}$

D. $g, \frac{g}{3}$

Answer:

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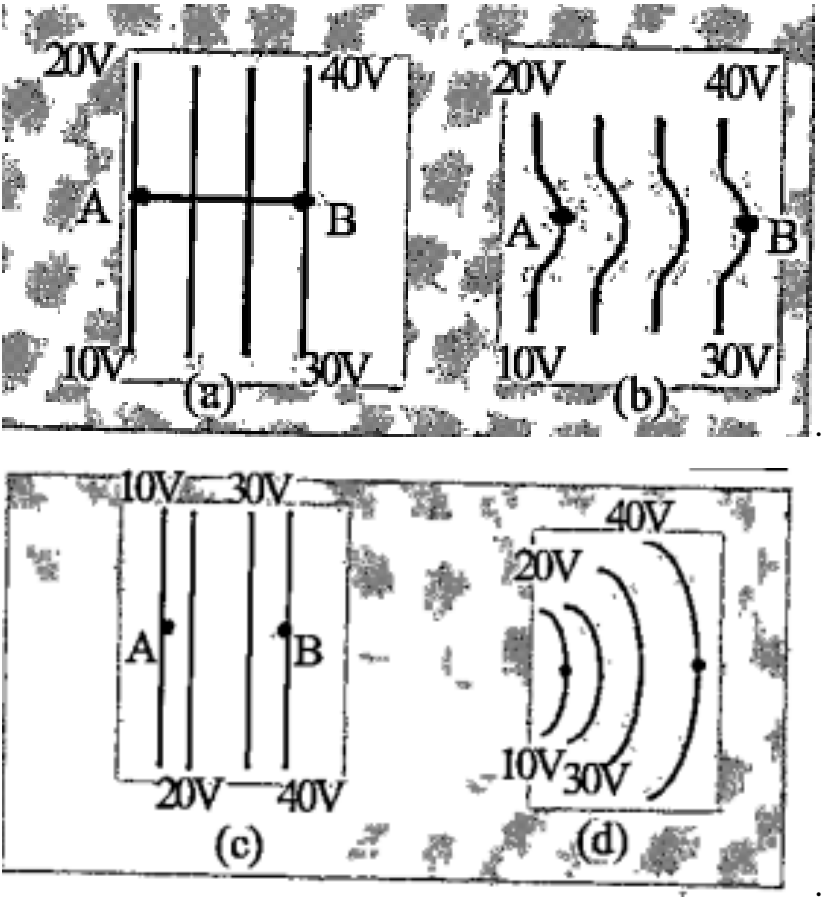
38. The diagram below show regions of equipotential.A positive charge is moved from A To B in each diagram.



A. In all the four cases the work done is the same

B. Minimum work is required to move q in figure (a)

C. Maximum work is required to move q in figure (b)

D. Maximum work is required to move q in figure (c)

Answer:

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39. A rope is wound round a hollow cylinder of mass 3 kg and radius 40 cm. What is the angular acceleration of the cylinder if the rope is pulled with a force of 30 N.

A. $0.25 rad / s^2$

B. $25 rad / s^2$

C. $5 m / s^2$

D. $25 m / s^2$

Answer:

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