PHYSICS

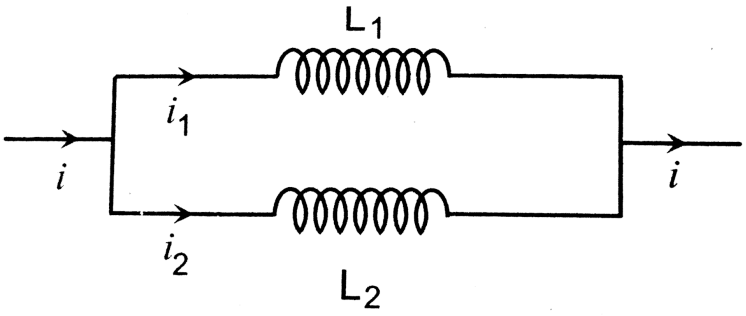
BOOKS - BITSAT GUIDE

SOLVED PAPER 2018

Part I Physics

1. Two inductors L_1 and L_2 are connected in parallel and a time varying current flows as shown.

the ratio of current i_1 / i_2



A. $\frac{L_2}{L_1}$

B. $\frac{L_1}{L_2}$

C. $\frac{L_2^2}{(L_1 + L_2)^2}$

D. $\frac{L_1^2}{(L_1 + L_2)^2}$

Answer: A

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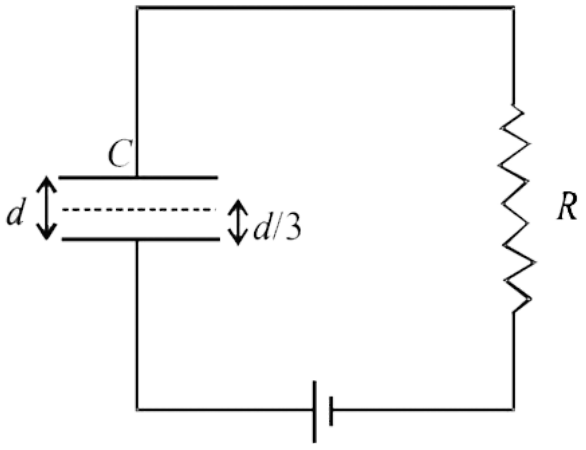
2. A parallel plate capacitor C with plates of unit area and separation d is filled with a liquid of dielectric constant $K = 2$. The level of liquid is $d/3$ initially. Suppose the liquid level decreases at a constant speed v, the time constant as a function of time t is-



A. $\frac{6\varepsilon_0 R}{5d + 3/t}$

B. $\frac{(15d + 9vt)\varepsilon_0 R}{2d^3 - 3dvt - gv^2t^2}$

C. $\frac{6\varepsilon_0 R}{5d - 3vt}$

D. $\frac{(15d - 9vt)\varepsilon_0 R}{2d^3 + 3dvt - 9v^2t^2}$

Answer: A

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3. Steam at $100^\circ C$ is passed into $1.1kg$ of water contained in a calorimeter of water equivalent $0.02kg$ at $15^\circ C$ till the

temperature of the calorimeter and its content rises to $80^{\circ}C$. What is the mass of steam condensed? Latent heat of steam = $536cal/g$.

A. .0130

B. 0.065

C. 0.260

D. 0.135

Answer: A

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4. Dimension of which base quantity corresponds to that of $\sqrt{\frac{Gh}{c^3}}$ = ?

A. Time

B. Length

C. Mass

D. Temperature

Answer: B

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5. Carnot engine takes one thousand kilo calories of heat from a reseervoir at $827^\circ C$ and exhausts it to a sink at $27^\circ C$. How, much work does it perform? What is the efficiency of the engine?

A. 2.7×10^5 cal, 70.70%

B. $2, 72 \times 10^5$, cal 72.72%

C. 2.70×10^5 cal, 80.70%

D. 3.70×10^5 cal, 70.70%

Answer: B

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6. A train moves towards a stationary observer with speed $34m/s$. The train sounds a whistle and its frequency registered by the observer is f_1. If the train's speed is reduced to $17m/s$, the frequency registered is f_2. If the speed of sound of $340m/s$, then the ratio f_1/f_2 is

A. $\frac{19}{18}$

B. $\frac{18}{19}$

C. 2

D. $1/2$

Answer: A

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7. An object of mass 5 kg is projecte with a velocity of $20ms^{-1}$ at an angle of 60° to the horizontal. At the highest point of its path , the projectile explodes and breaks up into two fragments of masses 1kg and 4 kg. The fragments separate horizontally after the

explosion, which releases internal energy such that $K.E.$ of the system at the highest point is doubled. Calculate the separation betweent the two fragments when they reach the ground.

A. 52.25m

B. 44.25m

C. 65.32m

D. 78.76m

Answer: B

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8. When an automobile moving with a speed of $36km/h$ reaches an upward inclined road of angle 30°, its engine is switched off. If the coefficient of friction is 0.1, how much distance will the automobile move before coming to rest ? Take $g = 10ms^{-2}$.

A. 12.53m

B. 21.42m

C. 15.43m

D. 8.53m

Answer: D

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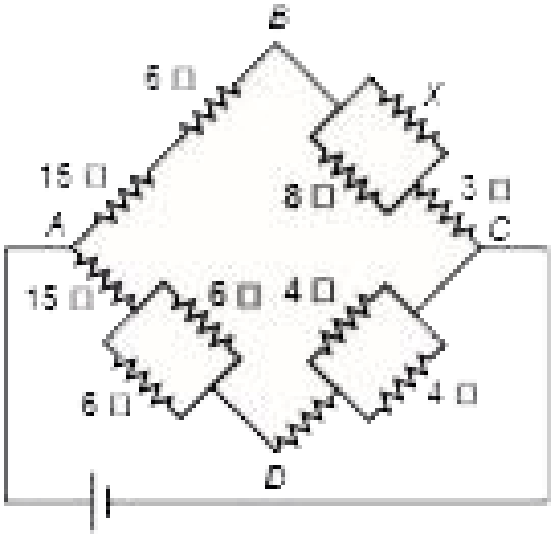
9. In the circuit given below, the value of resistance X, when the potential difference

between the point B and D is zero, will be



A. 9Ω

B. 8Ω

C. 4Ω

D. 6Ω

Answer: B

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10. A block of wood floats in water with $(4/5)th$ of its volume submerged. If the same block just floats in a liquid, the density of liquid in $\left(kgm^{-3}\right)$ is

A. 1250

B. 600

C. 400

D. 800

Answer: D

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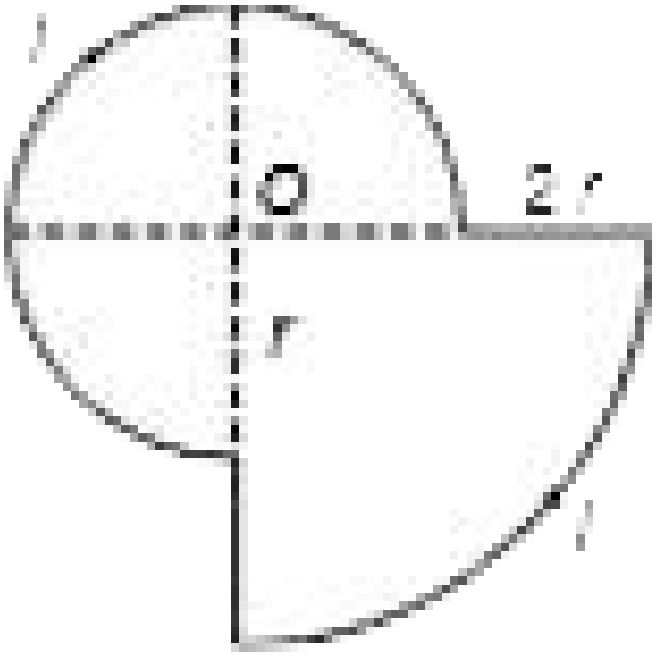
11. As current I flowing through the loop as shown in figure. The magnetic field at the

centre O is



A. $\frac{7\mu_0 i}{12r}$ acting downwards

B.

C. $\frac{5\mu_0 i}{12r}$ acting upwards $\frac{7\mu_0 i}{12r}$ acting upwards

D. $\frac{5\mu_0 i}{12r}$ acting downwards

Answer: D

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12. The ratio of angular momentum L to the atomic dipole moment μ_i for hydrogen like atoms and ions is

A. always constant and is equal to the ratio of mass to the charge of electron

B. always constant and is equal to twice the ratio of mass to the charge of electron to the principal quantum number n?

C. Proportional to the principal quantum number n

D. proportional to $\frac{1}{n^2}$

Answer: A

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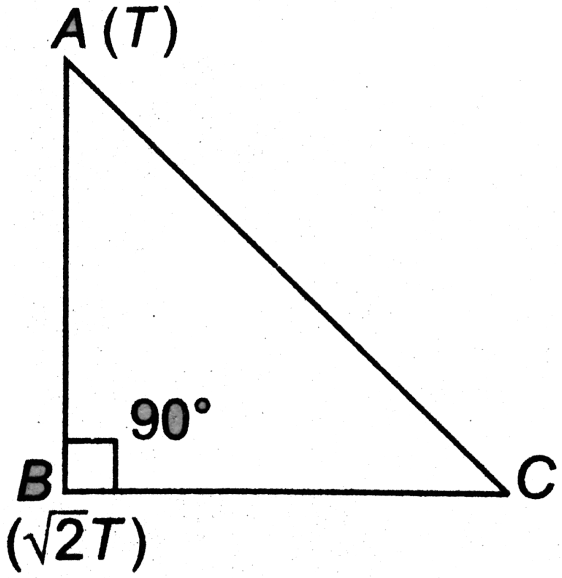
13. Three rods of identical cross-sectional area and made from the same metal form the sides of an isosceles triangle ABC right angled at B as shown in the figure. The points A and B are maintained at temperature T and $\left(\sqrt{2}\right)T$ respectively in the steady state. Assuming that only heat conduction takes place, temperature

of point C will be



A. $\frac{T}{\sqrt{2}+1}$

B. $\frac{T}{\sqrt{2}-1}$

C. $\frac{3T}{\sqrt{2}+1}$

D. $\frac{\sqrt{3}T}{\left(\sqrt{2}+1\right)}$

Answer: C

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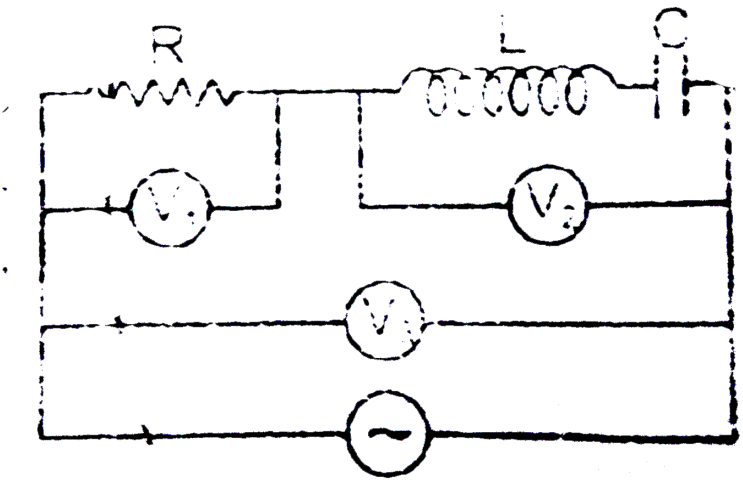
14. A resistor R, an inductor L, a capacitor C and voltmeters V_1, V_2 and V_3 are connected to an oscillator in the circuit as shown in the adjoining diagram.When the frequency of the oscillator is increased, upto resonance frequency, the voltmeter reading (at

resonance frequency) is zero in the case of:



A. voltmeter V_1 only

B. voltmeter V_2 only

C. voltmeter V_3 only

D. All the three voltmeters

Answer: B

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15. In Young's double slit experiment intensity at a point is $\left(\frac{1}{4}\right)$ of the maximum intersity. Angular position of this point is

A. $\sin^{-1}\left(\frac{\lambda}{d}\right)$

B. $\sin^{-1}\left(\frac{\lambda}{2d}\right)$

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

D. $\sin^{-1}\left(\frac{\lambda}{4d}\right)$

Answer: C

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16. The bob of a simple pendulum is a spherical hollow ball filled with water. A plugged hole near the bottom of the oscillating bob gets suddenly unplugged. During observation, till water is coming out, the time period of oscillation would

A. first increase and then decrease to the original value

B. first decrease and then increase to the original value

C. remain unchanged

D. increase towards a saturation value

Answer: A

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17. An electric field us applied to a semiconductor.Let the number of charge carriers be n and the average drift speed be v.If the temperature is increased,

A. n will increase but v will decrease

B. n will decrease but v will increase

C. Both n and v will increase

D. Both n and v will decrease

Answer: A

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18. consider the acceleration velocity and displacement of a tennis ball as it falls to the ground and bouces back. Derections of which of these changes in the process

A. velocity only

B. Displacemetn and velocity

C. Acceleration, velocity and displacement

D. Displacement and acceleration

Answer: B

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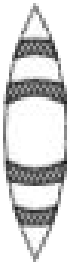
19. A convex lens shown in the figure is made up of two types of transparent materials. A point sources of light is placed on its principal axis. If reflections from the boundaries between layers are ignored, the lens wil form



A. only one image

B. two images

C. infinite images

D. no image at ll

Answer: B

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20. If the time period is doubled, then the angular momentum of the body will (provided the moment of inertia of the body is constant)

A. remain constant

B. quadruple

C. become half

D. double

Answer: C

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21. if ρ is the density of the meterial of a wire and σ is the breaking stress. The greatest

length of the wire that can hang freely without breaking is

A. $\frac{p}{\rho g}$

B. $\frac{p}{2\rho g}$

C. $\frac{2p}{\rho g}$

D. None of these

Answer: A

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22. A particle is projected with velocity $2\sqrt{gh}$ so that it just clears two walls of equal height h which are at a distance 2h from each other. Show that the time of passing between the walls is $2\sqrt{h/g}$.

A. $\sqrt{\frac{h}{g}}$

B. $\sqrt{\frac{2h}{g}}$

C. $2\sqrt{\frac{h}{g}}$

D. $\frac{2h}{g}$

Answer: C

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23. A given object takes n times as much time to slide down a 45° rough incline as it takes to slide down a perfectly smooth 45° incline. The coefficeint of kinetic friction between the object and the incline is given by:

A. $n^2 - 1$

B. $1 - \frac{1}{n^2}$

C. $n^2 + 1$

D. $1 + \frac{1}{n^2}$

Answer: B

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24. Some amount of a radioactive substance (half-life =10 days) is spread inside a room and consequently the level of radiation become 50 times the permissible level for normal

occupancy of the room. After how many days will the room be safe for occupation?.

A. 20 days

B. 34.8 days

C. 56.4 days

D. 62.9 days

Answer: C

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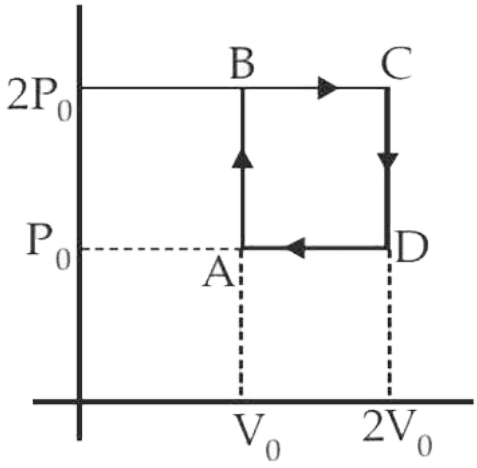
25. Helium gas goes through a cycle ABCDA (consisting of two isochoric and isobaric lines) as shown in figure Efficiency of this cycle is nearly: (Assume the gas to be close to ideal gas)



A. $15.4\,\%$

B. $9.1\,\%$

C. $10.5\ \%$

D. $12.5\ \%$

Answer: A

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26. The frequency and the intensity of a beam of light falling on the surface of a photoelectric material are increased by a factor of two. This will

A. increase the maximum kinetic energy of the ejected photoelectrons by a factor of more than two and would increase the photoelectric current by a factor of two

B. increase the maximum kinetic energy of the photo electrons and would increase the photoelectric current both by a factor of two.

C. increase the maximum kinetic energy of the photoelectrons by a factor of two

and will have no effect on the magnitude of the photoelectric current produced.

D. not produce any effect on the kinetic energy of the emitted photoelectrons but will increase the photoelectric current by a factor of two

Answer: A

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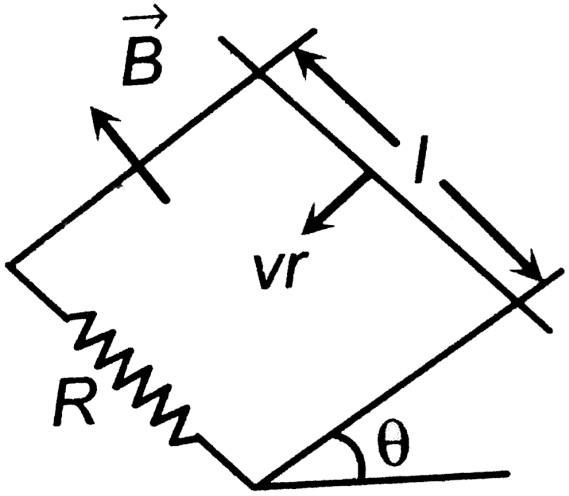
27. A copper rod of mass m slides under gravity on two smooth parallel rails l distance apart set at an angle θ to the horizontal. At the bottom, the rails are joined by a resistance R.



There is a uniform magnetic field

perpendicular to the plane of the rails. the terminal valocity of the rod is

A. $\frac{mgR\tan\theta}{B^2l^2}$

B. $\frac{mgR\cot\theta}{B^2l^2}$

C. $\frac{mgR\sin\theta}{B^2l^2}$

D. $\frac{mgR\cos\theta}{B^2l^2}$

Answer: C

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28. An asteroid of mass m is approaching earth, initially at a distance $10R_E$ with speed v_i. It hits earth with a speed v_f (R_E and M_E are radius and mass of earth),. Then

A. $v_f^2 = v_i^2 + \frac{2GM}{R_e}\left(1 + \frac{1}{10}\right)$

B. $v_f^2 = v_i^2 + \frac{2GM_e}{R_e}\left(1 + \frac{1}{10}\right)$

C. $v_f^2 = v_i^2 + \frac{2GM_e}{R_e}\left(1 - \frac{1}{10}\right)$

D. $v_f^2 = v_i^2 + \frac{2GM}{R_e}\left(1 - \frac{1}{10}\right)$

Answer: C

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29. When photons of energy 4.25eV strike the surface of a metal A, the ejected photoelectrons have maximum kinetic energy, T_A (expressed in eV) and deBroglie wavelength λ_A. The maximum kinetic energy of photoelectrons liberated from another metal B by photons of energy 4.20V is $T_B = T_A - 1.50eV$. If the deBroglie wavelength of those photoelectrons is $\lambda_B = 2\lambda_A$ then

A. The work function of A is 1.50eV

B. The work function of B is 4.0 eV

C. $T_A = 3.2eV$

D. All of the above

Answer: B

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30. A pulley os radius 2m is rotated about its axis by a force $F = \left(20t - 5t^2\right)$ newton (where t is measured in seconds) applied

tangentially. If the moment of inertia of the pulley about its axis of rotation is $10kgm^2$ the number of rotaitons made by the pulley before its direction of motion is reversed, is:

A. more than 3 but less than 6

B. more than 6 but less than 9

C. more than 9

D. less than 3

Answer: A

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31. A plano-convex lens has thickness 4cm. When places on a horizontal table with the curved surface in contact with it, the apparent depth of the bottom-most point of the lens if found to be 3cm. If the lens is inverted such that the plane face is in contact with the table, the apparent depth of the center of the plane face of the lens is face of the lens is found to be $25/8$ cm. Find the focal length of the lens.

A. 85cm

B. 59cm

C. 75cm

D. 7.5cm

Answer: C

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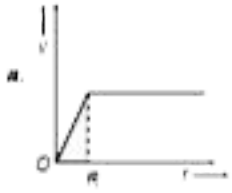
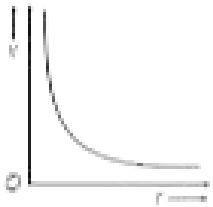
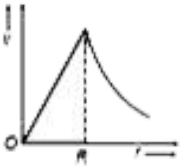
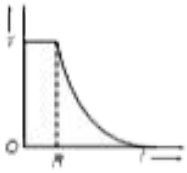
32. A spherically symmetric gravitational system of particles has a mass density $\rho = \begin{cases} \rho_0 & f \text{ or } r < R \\ 0 & f \text{ or } r > R \end{cases}$ where ρ_0 is a constant. A test mass can undergo circular

motion under the influence of the gravitational field of particles. Its speed v as a function of distahce $r(0 < r < OO)$ form the centre of the system is represented by

A. 

B. 

C. 



D.

Answer: C

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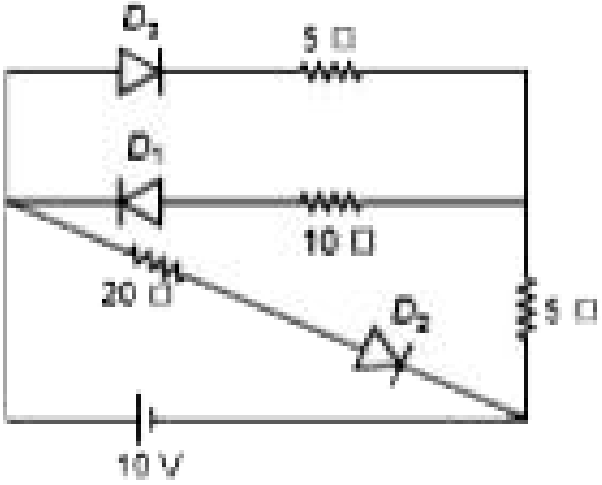
33. In the given circuit,



The current through battery is

A. 0.5A

B. 1A

C. 1.5A

D. 2.5A

Answer: C

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34. A trolley having mass of 200kg moves with uniform speed of $36kmh^{-1}$ on a frictionless track. A child of mass 20 kg runs on the trolley from one end to the other (10 m away) with a speed of $4ms^{-1}$ relative to the trolley in a direction opposite to its motion and ultimately jumps out of the trolley. with how much velocity has the trolley moved from the time the child begins to run?

A. $10.36ms^{-1}$

B. $11.36ms^{-1}$

C. $12.36ms^{-1}$

D. $14.40ms^{-1}$

Answer: A

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35. A gas has molar heat capacity $C = 37.55J\text{mole}^{-1}K^{-1}$, in the process PT = constant, find the number of degree of freedom of the molecules of the gas.

A. 2

B. 3

C. 5

D. 7

Answer: C

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36. If x, v and a denote the displacement, the velocity and the acceleration of a particle executing simple harmonic motion of time

period T, then, which of the following does not change with time ?

A. $\frac{aT}{x}$

B. $aT + 2\pi v$

C. $\frac{aT}{v}$

D. $a^2T^2 + 4\pi^2v^2$

Answer: A

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37. To increase the current sensitivity of a moving coil galvanometer by $50\,\%$ its resistance is increased so that the new resistance becomes twice its initial resistance. By what factor does its voltage sensitivity change?

A. Increases by 15%

B. Decreases by 15%

C. Increases by 25%

D. Decreases by 25%

Answer: D

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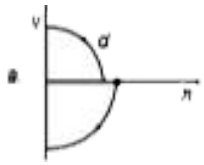
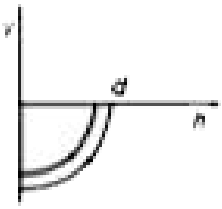
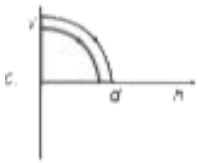
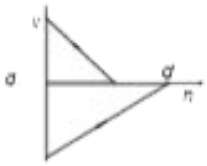
38. v34

A. 

B. 

C. 

D. 

Answer: A

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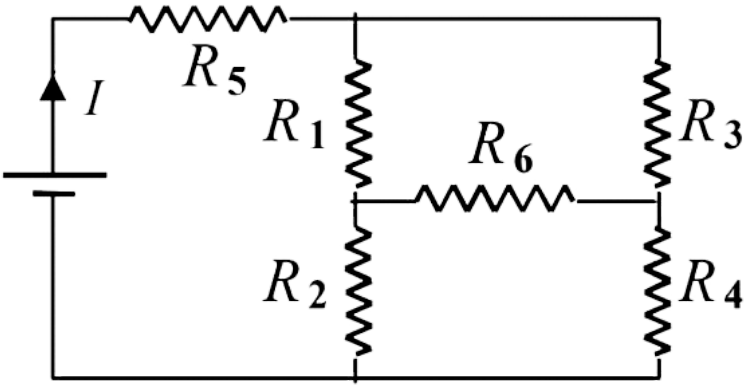
39. In the given circuit, it is observed that the current I is independent of the value of the resistance R_6. Then the resistance values must

satisfy



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A. $\frac{1}{R_5}+\frac{1}{R_6}=\frac{1}{R_1+R_2}\cdot\frac{1}{R_3+R_4}$

B. $R_1R_4=R_2R_3$

C. $R_1R_2R_5=R_3R_4R_6$

D. $R_1R_3=R_2R_4=R_5R_6$

Answer: B

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40. If a drop of liquid breaks into smaller droplets, it result in lowering of temperature of the droplets. Let a drop of radius R, breaks into N small droplets each of radius r. Estimate the drop in temperature.

A. $\frac{3T}{\rho S}\left[\frac{1}{r}-\frac{1}{R}\right]$

B. $-\frac{2T}{\rho S}\left[\frac{1}{r}-\frac{1}{R}\right]$

C. $\frac{2R}{\rho S}\left[\frac{1}{R}-\frac{1}{r}\right]$

D. $\frac{3T}{\rho S}\left[\frac{1}{R}-\frac{1}{r}\right]$

Answer: D

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