PHYSICS

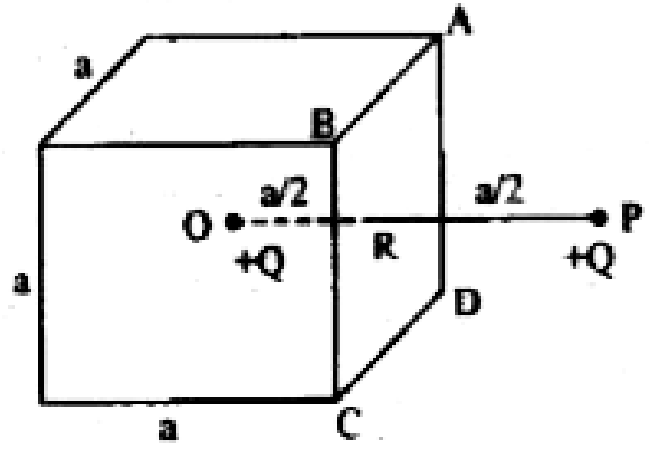
BOOKS - MTG PHYSICS (BENGALI ENGLISH)

QUESTION PAPER 2018

Physics

1. Consider a region in free space bounded by the surfaces of an imaginary cube having sides

of length a as shown in the diagram. A charge +Q is placed at the centre O of the cube. P is such a point outside the cube that the line OP perpendicularly intersects the surface ABCD at R and also $OR = a/2$. A charge +Q is placed at point P also. What is the total electric flux through the five faces of the cube other than ABCD?



A. $\frac{Q}{\varepsilon_0}$

B. $\frac{5Q}{6\varepsilon_0}$

C. $\frac{10Q}{6\varepsilon_0}$

D. zero`

Answer:

Watch Video Solution

2. For equal charges of value +Q are placed at any four vertices of a regular hexagon of side a. By suitably choosing the vertices, what can

be the maximum possible magnitude of electric field at the centre of the hexagon?

A. $\frac{Q}{4\pi\varepsilon_0 a^2}$

B. $\frac{\sqrt{2}Q}{4\pi\varepsilon_0 a^2}$

C. $\frac{\sqrt{3}Q}{4\pi\varepsilon_0 a^2}$

D. $\frac{2Q}{4\pi\varepsilon_0 a^2}$

Answer:

Watch Video Solution

3. A proton of mass m moving with a speed $v(<< c$, velocity of light in vacuum) completes a circular orbit in time T in a uniform magnetic field. If the speed of the proton in increased to $\sqrt{2}$v, what will be time needed to complete the circular orbit?

A. $\sqrt{2}T$

B. T

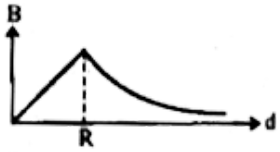
C. $\frac{T}{\sqrt{2}}$

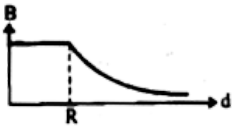
D. $\frac{T}{2}$

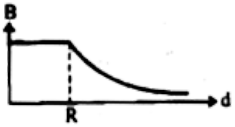
Answer:

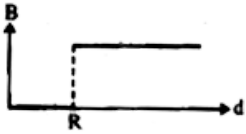
Watch Video Solution

4. A uniform current is flowing along the length of an infinite, straight, thin, hollow, cylinder of radius R. The magnitude field B produced at a perpendicular distance d from the axis of the cylinder is plotted in a graph. Which of the following looks like the plot?









Watch Video Solution

5. A circular loop of radius r of conducting wire connected with a voltage source of zero internal resistance produces a magnetic field B at its centre. If instead, a circular loop of

radius 2r, made of same material having the same cross section is connected to the same voltage source, what will be magnetic field at its centre?

A. $\frac{B}{2}$

B. $\frac{B}{4}$

C. $2B$

D. B

Answer:

Watch Video Solution

6. An alternating current is flowing through a series LCR circuit. It is found that the current reaches a value of 1mA at bolth 200 Hz and 800Hz frequency. What is the resonance frequency of the circuit?

A. 600Hz

B. 300Hz

C. 500Hz

D. 400Hz

Answer:

Watch Video Solution

7. An electric bulb, a capacitor, a battery and a switch are all in series in a circuit. How does the intensity of light vary when the switch is turned on?

A. Continues to increase gradually.

B. Gradually increases for some time and then becomes steady.

C. Sharply rises initially and then gradually decreases.

D. Gradually increases for some time and then gradually decreases.

Answer:

Watch Video Solution

8. Four resistors, 100Ω, 200Ω, 300Ω and 400Ω are connected to form four sides of a square. The resistors can be connected in any order.

What is the maximum possible equivalent resistance across the diagonal of the square?

A. 210Ω

B. 240Ω

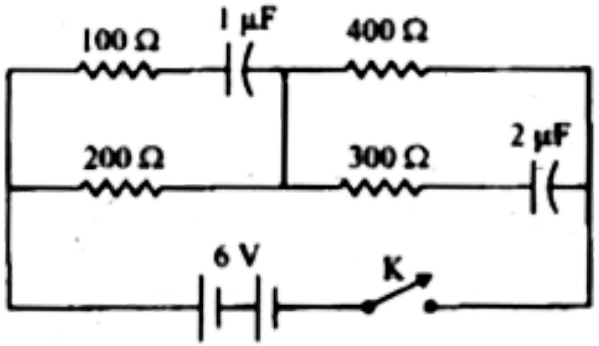
C. 300Ω

D. 250Ω

Answer:

Watch Video Solution

9. What will be current through the 200Ω resistor in the given circuit a long time after the switch K is made on?



A. zero

B. 100mA

C. 10mA

D. 1mA

Answer:

Watch Video Solution

10. A point source is placed at co-ordinates (0,1), in X-Y plane. A ray of light from the source is reflected on a plane mirror placed along the X-axis and perpendicular to the X-Y plane. The reflected ray passes through the point (3,3). What is the path length of the ray from (0,1) to (3,3)?

A. 5

B. $\sqrt{13}$

C. $2\sqrt{3}$

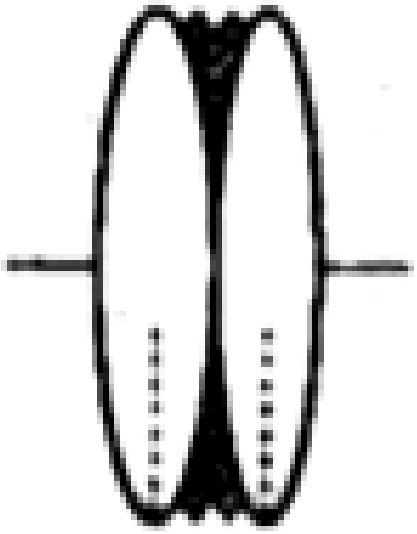
D. $1 + 2\sqrt{3}$

Answer:

Watch Video Solution

11. Two identical equiconvex lenses, each of focal length f, are placed side by side in contact with each other with a layer of water

in between them as shown in the figure. If refractive index of the material of the lenses is greater than that of water, how the combined focal length F is related to f?



A. $F > f$

B. $\frac{f}{2} < F < f$

C. $F < \frac{f}{2}$

D. $F = f$

Answer:

Watch Video Solution

12. There is a small air bubble at the centre of a solid glass sphere of radius r and refractive index μ. What will be the apparent distance of the bubble from the centre of the sphere, when viewed from outside?

A. r

B. $\frac{r}{\mu}$

C. $r\left(1-\frac{1}{\mu}\right)$

D. zero`

Answer:

Watch Video Solution

13. If Young's double slit experiment is done with white light, which of the following statements will be true?

A. All the bright fringes will be coloured.

B. All the bright fringes will be white.

C. The central fringe will be white.

D. No stable interference pattern will be visible.

Answer:

Watch Video Solution

14. How the linear velocity v of an electron in the bOhr orbit is related to its quantum number n?

A. $v \propto \frac{1}{n}$

B. $v \propto \frac{1}{n^2}$

C. $v \propto \frac{1}{\sqrt{n}}$

D. $v \propto n$

Answer:

Watch Video Solution

15. If the half life of a radioactive nucleus is 3 days, nearly what fraction of the initial number of nuclei wil decay on the 3rd day? (Given that $\sqrt[3]{0.25} \approx 0.63$)

A. 0.63

B. 0.5

C. 0.37

D. 0.13

Answer:

Watch Video Solution

16. An electron accelerated through a potential of 10,000 V from rest has a de-Broglie wave length λ. What should be the acceleratiig potential so that the wave length is doubled?

A. 20,00V

B. 40,000V

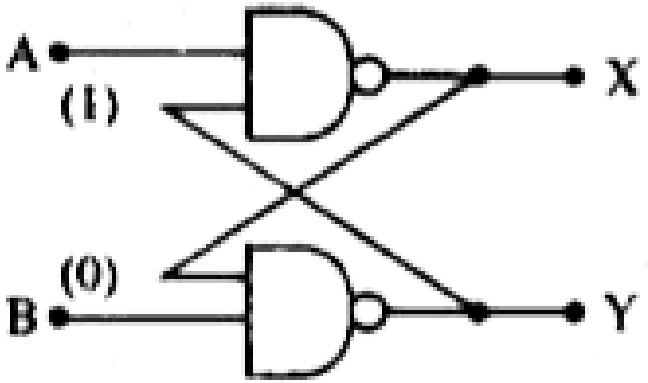
C. 5,000V

D. 2,500V

Answer:

Watch Video Solution

17. In the circuit shown inputs A and B are in states, 1 and 0 respectively. What is the only possible stable state of the outputs X and Y?



A. X=1,Y=1

B. X=1,Y=0

C. X=0,Y=1

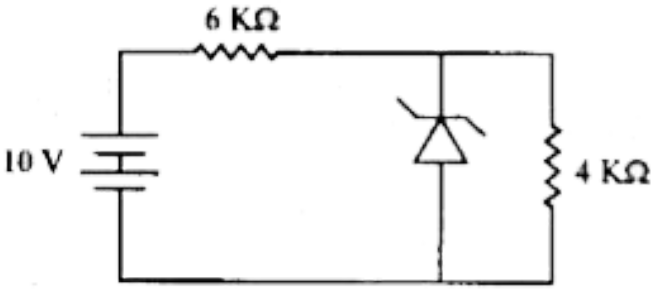
D. X=0,Y=0

Answer:

Watch Video Solution

18. What will be the current flowing through the 6 KΩ resistor in the circuit shown, where

the breakdown voltage of the zener is 6V?



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

B. $1mA$

C. $10mA$

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

Answer:

Watch Video Solution

19. In case of a simple harmonic motion, if the velocity is plotted along the X-axis and the displacement (from the equilibrium position) is plotted along the Y-axis, the resultant curve happens to be an ellipse with the ratio:

$$\frac{\text{major axis}(\text{along X})}{\text{minor axis}(\text{alongY})} = 20\pi$$

What is the frequency of the simple harmonic motion?

A. 100Hz

B. 20Hz

C. 10Hz

D. $\frac{1}{10}$ Hz

Answer:

Watch Video Solution

20. A block of mass m_2 is placed on a horizontal table and another block of mass m_1 is placed on top of it. An increasing horizontal force $F = \alpha t$ is exerted on the upper block but the lower block never moves as a result .If the co-efficient of friction between the blocks

is μ_1 and that between the lower block and the table is μ_2, then what is the maximum possible value of μ_1 / μ_2?

A. $\frac{\mu_2}{m_1}$

B. $1 + \frac{m_2}{m_1}$

C. $\frac{m_1}{m_2}$

D. $1 + \frac{m_1}{m_2}$

Answer:

Watch Video Solution

21. In a triangle ABC, the sides AB and AC are represented by the vectors $3\hat{i}+\hat{j}+\hat{k}$ and $\hat{i}+2\hat{j}+\hat{k}$ respectively. Calculate the angle $\angle aBC$.

A. $\cos^{-1}\sqrt{\frac{5}{11}}$

B. $\cos^{-1}\sqrt{\frac{6}{11}}$

C. $\left(90^\circ-\cos^{-1}\sqrt{\frac{5}{11}}\right)$

D. $\left(180^\circ-\cos^{-1}\sqrt{\frac{5}{11}}\right)$

Answer:

Watch Video Solution

22. The velocity (v) of a particle (under of force F) depends on its distance (x) from the origin (with $x > 0$) $v \propto \frac{1}{\sqrt{x}}$. Find how the magnitude of the force(F) on the particle depends on x.

A. $F \propto \frac{1}{x^{\frac{3}{2}}}$

B. $F \propto \frac{1}{x}$

C. $F \propto \frac{1}{x^2}$

D. $F \propto x$

Answer:

Watch Video Solution

23. The ratio of accelerations due to gravity $g_1 : g_2$ on the surfaces of two planets is 5:2 and the ratio of their respective average densities $p_1 : p_2$ is 2:1. What is the ratio of respective escape velocities $v_1 : v_2$ from the surface of the planets?

A. $5 : 2$

B. $\sqrt{5}:\sqrt{2}$

C. $5:2\sqrt{2}$

D. $25:4$

Answer:

Watch Video Solution

24. A spherical liquid drop is placed on a horizontal plane. A small disturbance causes the volume of the drop to oscillate. The time period of oscillation (T) of the liquid drop

depends on radius (r) of the drop, density (ρ) and surface tension (s) of the liquid. Which among the following will be a possible expression for T (where k is a dimensionless constant)?

A. $k\sqrt{\frac{\rho T}{s}}$

B. $k\sqrt{\frac{\rho^2 T}{s}}$

C. $k\sqrt{\frac{\rho r^3}{s}}$

D. $k\sqrt{\frac{r^3}{s^2}}$

Answer:

Watch Video Solution

25. The stress along the length of a rod (with rectangular cross section) is 1% of the Young's modulus of its material. What is the approximate percentage of change of its volume ? (Poisson's ratio of the material of the rod is 0.3)

A. 0.03

B. 0.01

C. 0.007

D. 0.004

Answer:

Watch Video Solution

26. What will be th approximate terminal velocity of a rain drop of diameter $1.8 \times 10^{-3} m$. When density of rain water $\approx 10^3 kgm^{-3}$ and the co-efficient of viscosity of air $\approx 1.8 \times 10^{-5} Nsm^{-2}$? (Neglect buoyacy of air)

A. $49ms^{-1}$

B. $98ms^{-1}$

C. $392ms^{-1}$

D. $980ms^{-1}$

Answer:

Watch Video Solution

27. The water equivalent of a calorimeter is 10g and it contains 50 g of water at $15^{\circ}C$. Some amount of ice, initially at $-10^{\circ}C$ is dropped

in it and half of the ice melts till equilibrium is reached. What was the initial amount of ice that was dropped (when specific heat of ice $= 0.5 \text{cal} gm^{-1} \circ C^{-1}$ specific heat of water $= 1.0 \text{cal} gm^{-1} \circ C^{-1}$ and laten heat of melting of ice $= 80 \text{cal} gm^{-1}$)?

A. 10g

B. 18g

C. 20g

D. 30g

Answer:

Watch Video Solution

28. One mole of a mono atomic ideal gas undergoes a quasi -static process,s which is depicted by a straight line joining points (V_0, T_0) and $(2V_0, 3T_0)$ is a V-T diagram. What is the values of the heat capacity of the gas at the point (V_0, T_0)?

A. R

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

C. $2R$

D. 0

Answer:

Watch Video Solution

29. For an ideal gas with initial pressure and volume P_i and V_i respectively a reversible isothermao expansion happens, when its volume becomes V_0. Then it is compressed to its original volume V_i by a reversible adiabatic process. If the final pressure is P_f, then which

of the following statements is true?

$P_f = P_i$

$P_f > P_i$

$P_f < P_i$

$\frac{P_f}{V_0} = \frac{P_i}{V_i}$

Watch Video Solution

30. A point charge -q is carried from a point A to another point B on the axis of a charged ring of radius r carrying a charge +q. If the point A is at a distance $\frac{4}{3}$ r from the centre of

the ring and the point B is $\frac{3}{4}$ r from the centre but on the opposite side, what is the net work that need to be done for this?

A. $-\frac{7}{5}\left(\frac{q^{20}}{4\pi\varepsilon_0 r}\right)$

B. $-\frac{1}{5}\frac{q^2}{4\pi\varepsilon_0 r}$

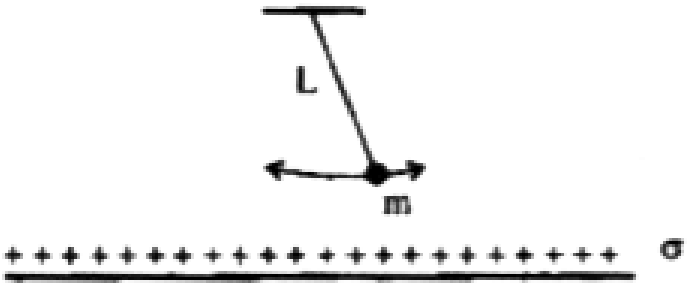
C. $\frac{7}{5}\frac{q^2}{4\pi\varepsilon_0 r}$

D. $\frac{1}{5}\frac{q^2}{4\pi\varepsilon_0 r}$

Answer:

Watch Video Solution

31. The bob of a pendulum of mass m, suspended by an inextensible string of length L as shown in the figure carries a small charge q. An infinite horizontal plane conductor with uniform surface charge density σ is placed below it. What will be the time period of the pendulum for small amplitude oscillations?



A. $2\pi\sqrt{\dfrac{L}{\left(g-\frac{mq}{\varepsilon_0\sigma}\right)}}$

B. $\sqrt{\frac{L}{\left(g-\frac{mq\sigma}{\varepsilon_0}\right)}}$

C. $\frac{1}{2\pi}\sqrt{\frac{L}{\left(g-\frac{q\sigma}{\varepsilon_0 m}\right)}}$

D. $2\pi\sqrt{\frac{L}{\left(g-\frac{q\sigma}{\varepsilon_0 m}\right)}}$

Answer:

Watch Video Solution

32. A light charged particle is revolving in a circle of radius r in electrostatic attraction of a static heavy particle with opposite charge.

How does the magnetic field B at the centre of the circule due to the movig charge depend on r?

A. $B \propto \frac{1}{r}$

B. $B \propto \frac{1}{r^2}$

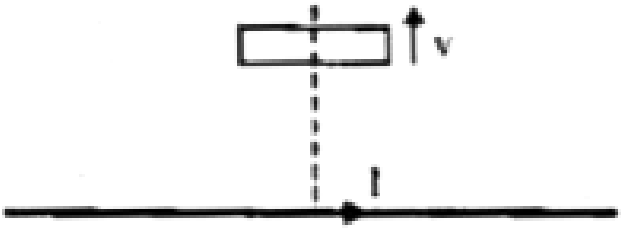
C. $B \propto \frac{1}{r^{\frac{3}{2}}}$

D. $B \propto \frac{1}{r^{\frac{5}{2}}}$

Answer:

Watch Video Solution

33. As shown in the figure, a rectangular loop of a conducting wire is moving away with a constnant velocity v in a perpendicular direction from a very long straight conductor carrying a steady curent I. When the breadth of the rectangular loop is very small compared to its distance from the straight conductor, how does the emf E induced in the loop vary with time t?



A. $E \propto \frac{1}{t^2}$

B. $E \propto \frac{1}{t}$

C. $E \propto -In(t)$

D. $E \propto \frac{1}{t^3}$

Answer:

Watch Video Solution

34. A solid spherical ball and a hollow spherical ball of two different materials of densities ρ_1 and ρ_2 respectively have same

outer radii and same mass. What will be the ratio the moment of inertia (about an axis passing through the centre) of the hollow sphere to that of the solid sphere?

A. $\frac{\rho_2}{\rho_1}\left(1-\frac{\rho_2}{\rho_1}\right)^{\frac{5}{3}}$

B. $\frac{\rho_2}{\rho_1}\left[1-\left(1-\frac{\rho_2}{\rho_1}\right)^{\frac{5}{3}}\right]$

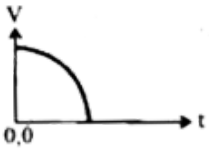
C. $\frac{\rho_2}{\rho_1}\left(1-\frac{\rho_1}{\rho_2}\right)^{\frac{5}{3}}$

D. $\frac{\rho_2}{4ho_1}\left[1-\frac{\rho_1}{(\rho_2)^{\frac{5}{3}}}\right]$

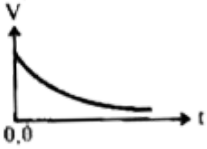
Answer:

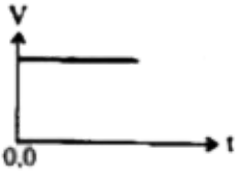
Watch Video Solution

35. The insultated plates of a charged parallel capacitor (with small separation between the plates) are approaching each other due to electrostatic attraction. Assuming no other force to the operative and no radiation taking place, which of the following graphs approximately shows the variation with the (t) of the potential difference (V) between the plates?

A. 

B. 

C. 

D. 

Answer:

Watch Video Solution

36. Two positive charges Q and 4Q are placed at points A and B respectively where B is at a distance d units to the right of A. The total electric potential due to these charges is minimum at P on the line through A and B. What is (are) the distance (s) of P from A?

A. $\frac{d}{3}$ units of the right of A

B. $\frac{d}{3}$ units to the left of A

C. $\frac{d}{5}$ units to the right of A

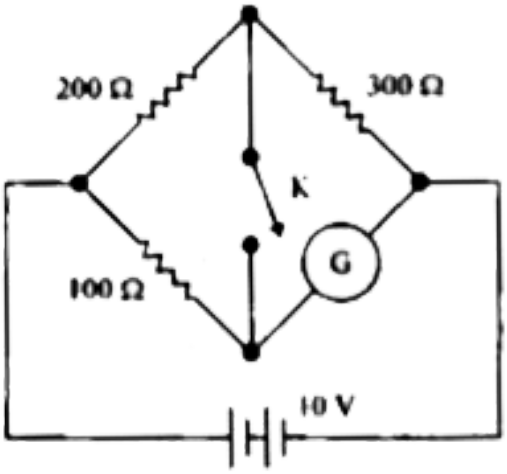
D. d units to the left of A

Answer:

Watch Video Solution

37. A non zero current passes through the galvanometer G shown in the circuit when the key K is closed and its value does not change when the key is opened. Then which of the

following statement(s) is /are true?



A. The galvanometer resistance is infinite.

B. The current through the galvanometer is

40 mA

C. After the key is closed, the current the

200Ω resistor is same as the current

through the 300Ω resistor.

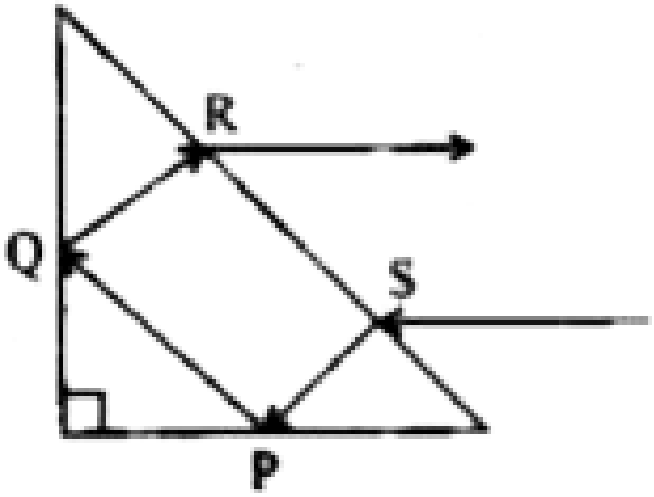
D. The galvaometer resistance is 150Ω

Answer:

Watch Video Solution

38. A ray of light is incident on a right angled isosceles prism parallel to its base as shown in the figure. Refractive index of the material of the prism is $\sqrt{2}$. Then which of the following

statements (s) is /are true?



A. The reflection at P is total internal.

B. the reflection at Q is total internal.

C. The ray emerging at R is parallel to the ray incidet at S.

D. Total deviation of the ray is 150°

Answer:

 Watch Video Solution

39. The intensity of a sound appears to an observer to be periodic. Which of the following can be the cause of it?

A. The intensity of the source is periodic.

B. The source is moving towards the observer.

C. The observer is moving away from the source.

D. The source is producing a sound composed of two nearby frequencies.

Answer:

Watch Video Solution

40. Which of the following statements(s) is/are true?

Internal energy of an ideal gas_____

A. decreases in an isothermal process.

B. remains constant in an isothermal process.

C. increases in an isobaric process.

D. decreases in an isobaric expansion.

Answer:

Watch Video Solution