23/08/2022

Slot-1

Aakash + BYJU'S

Corporate Office : Aakash Tower, 8, Pusa Road, New Delhi-110005 | Ph.: 011-47623456

Answers & Solutions

Time : 45 min. *for* M.M. : 200

CUET UG-2022

(Physics)

IMPORTANT INSTRUCTIONS:

1. The test is of 45 Minutes duration.
2. The test contains 50 Questions out of which 40 questions need to be attempted.
3. Marking Scheme of the test:
   a. Correct answer or the most appropriate answer: Five marks (+5)
   b. Any incorrect option marked will be given minus one mark (–1).
   c. Unanswered/Marked for Review will be given no mark (0).

Choose the correct answer :

Question ID: 702901

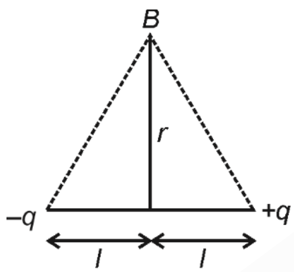
Electric potential due to dielectric dipole on equational line at distance r from the centre of the dipole is (P = dipole moment) (assume dipole as very short)

(A) $V = \pm\frac{1}{4\pi\varepsilon_0}\frac{P}{r^2}$ (B) $V = \pm\frac{1}{4\pi\varepsilon_0}\frac{2P}{r^2}$

(C) $V = \pm\frac{1}{4\pi\varepsilon_0}\frac{P}{r^3}$ (D) $V = 0$

Answer (D)

Sol. $V_B = \frac{kq}{\sqrt{r^2+l^2}} - \frac{kq}{\sqrt{r^2+l^2}}$



$V_B = 0$

Question ID: 702902

The electrostatic force between the plates of an isolated parallel plate capacitor having charge Q and area of each plate A is

(A) $\frac{Q^2}{2A\varepsilon_0}$ (B) $Q^2 2A\varepsilon_0$

(C) $\frac{\sigma}{2\varepsilon_0}$ (D) $\frac{Q}{2A\varepsilon_0}$

Answer (A)

Sol. For isolated capacitor

Q = constant

$$F_{\text{Plate}} = \frac{Q^2}{2A\varepsilon_0}$$

Question ID: 702903

Two point charges q_A = 3μC and q_B = –3μC are located 2m apart in vacuum. The electric field at midpoint of the line joining the two charges is

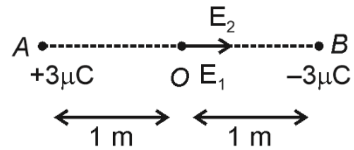
(A) 5.4×10^4 N/C (B) 1.35×10^4 N/C

(C) 2.7×10^4 N/C (D) Zero

Answer (A)

Sol. $q_A = 3 \times 10^{-6}$ C

$q_B = -3 \times 10^{-6}$ C



Electric field at O

$E = E_1 + E_2$

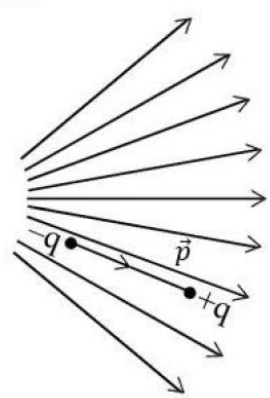
$$= 2 \times \frac{3\times10^{-6}\times9\times10^9}{1^2}$$

$= 54 \times 10^3$

$= 5.4 \times 10^4$ N/C

Question ID: 702904

Figure shows electric field lines in which an electric dipole $\vec{p}$ is placed as shown. Which of the following statements is correct?



(A) The dipole will not experience any force

(B) The dipole will experience a force in the direction of $\vec{p}$

(C) The dipole will experience a force opposite to $\vec{p}$

(D) The dipole will experience a force perpendicular to $\vec{p}$

Answer (C)

Sol. Space between electric field lines is increasing here from left to right so strength of electric field decreases with the increase in the space between electric field lines.

∴ Force on charge $-q$ is greater than force on $+q$, so net force is opposite to $\vec{p}$.

Question ID: 702905

A system consisting of two point charges 7μC and –4μC are placed at (–9, 0, 0) cm and (9, 0, 0) cm respectively. The electrostatic potential energy of the system is

(A) –0.7 J (B) –1.4 J

(C) –3.6 J (D) –6.8 J

Answer (B)

Sol. $q_1 = 7\mu C$, $A = (-9, 0, 0)$

$q_2 = -4\mu C$, $B = (9, 0, 0)$

$\Rightarrow$ r = 18 cm

= 0.18 m

Electrostatic potential energy

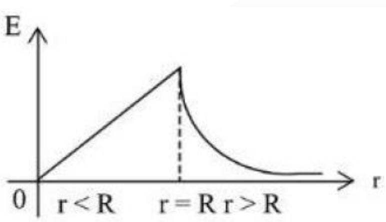
$$U_i = \frac{1}{4\pi\varepsilon_0}\frac{q_1 \cdot q_2}{r} = \frac{9\times10^9\times7\times10^{-6}\times(-4)\times10^{-6}}{(0.18)}$$

$U_i = 1400 \times 10^{-3} = -1.4$ J

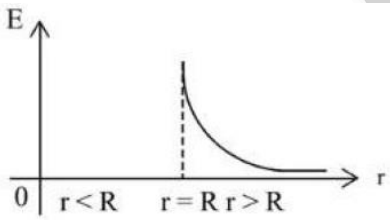
Question ID: 702906

Variation of Electric field intensity due to a uniformly charged conducting spherical shell of radius R with the distance from the centre of the shell can be represented by following graph

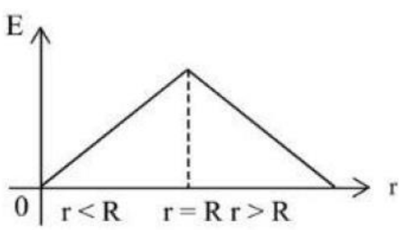
(A)



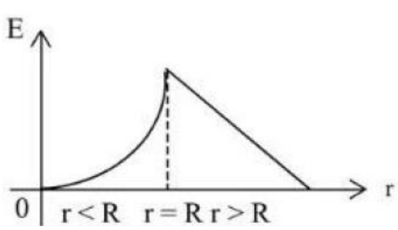
(B)



(C)



(D)



Answer (B)

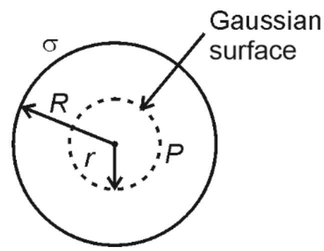
Sol. P is inside the shell

Gaussian surface contains no charge

$q = 0$

$\therefore$ $E = 0$ (inside shell)

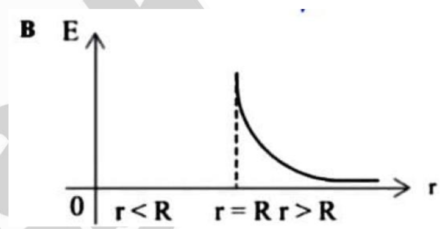
$r = R$



$$E = \frac{q}{4\pi R^2\varepsilon_0} = \frac{\sigma}{\varepsilon_0} \Rightarrow E \propto \frac{1}{R^2}$$

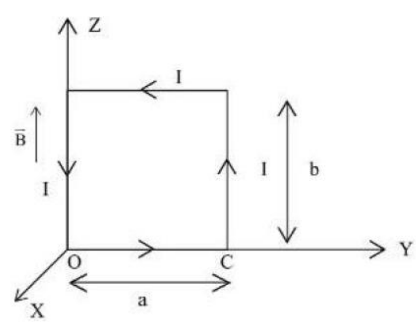
for $r > R$

$$E = \frac{q}{4\pi r^2\varepsilon_0} \Rightarrow E \propto \frac{1}{r^2}$$



Question ID: 702907

A uniform magnetic field $\vec{B}$ is established along the positive z-direction. A rectangular loop of sides 'a' and 'b' carries a current of I as shown in figure. The torque in the loop is



(A) $IabB\left(-\hat{j}\right)$ (B) $IabB\left(\hat{j}\right)$

(C) $IabB\left(\hat{k}\right)$ (D) $IabB\left(-\hat{i}\right)$

Answer (A)

Sol. $\tau = I\vec{A}\times\vec{B}$

$\Rightarrow$ $A = ab$ (normal to y-z plane)

$= ab\hat{i}$

B is directed along z-axis

$\therefore\ \ \tau = I\left[ab\hat{i} \times B\hat{k}\right]$

$\tau = -IabB\hat{j}$

Question ID: 702908

A charged particle with charge q and mass 'm' is moving with velocity 160 ms^{-1} in the region of magnetic field B at an angle 60° with the direction of $\vec{B}$. The pitch of helix formed by particle will be

(A) $\dfrac{100\pi m}{qB}$ (B) $\dfrac{120\pi}{qB}$

(C) $\dfrac{160\pi m}{qB}$ (D) $\dfrac{80\pi m}{qB}$

Answer (C)

Sol. Pitch of helix $= v\cos\theta \cdot \left(\dfrac{2\pi m}{qB}\right)$

$= 160 \times \cos 60° \cdot \left(\dfrac{2\pi m}{qB}\right)$

$= \dfrac{160\pi m}{qB}$

Question ID: 702909

In an atom, an electron with charge 'e' and mass m is revolving around the nucleus in a specific orbit with angular momentum $(\vec{L})$ and the equivalent magnetic dipole moment (μ) of that atom is $\vec{\mu} = -\dfrac{e}{2m}\vec{L}$, where $\dfrac{e}{2m}$ will be

(A) Bohr's magneton

(B) Gyromagnetic ratio

(C) Specific charge of electron

(D) Orbital magnetic moment

Answer (B)

Sol. Gyromagnetic ratio $= \dfrac{M}{L}$

Where, M = Magnetic moment of revolving electron

L = Angular momentum of e^-

$M = niA$

$= \dfrac{ne \times \pi r^2}{T} = \dfrac{nev \times \pi r^2}{2\pi r}$

$= \dfrac{nevr}{2}$

$L = mvr$

Gyromagnetic ratio $= \dfrac{nevr}{2 \times mvr}$ $\Rightarrow$ for $n = 1$

$= \dfrac{e}{2m}$

Question ID: 7029010

A solenoid of length 0.5 m and radius 10 cm has 500 turns. If a current of 5 A flows through it, the magnetic field produced inside the solenoid will be

(A) 1.4×10^{-3} T

(B) 2.8×10^{-3} T

(C) 4.8×10^{-3} T

(D) 6.28×10^{-3} T

Answer (D)

Sol. $B = \dfrac{\mu_0 NI}{\ell} = \dfrac{4\pi \times 10^{-7} \times 500 \times 5 \times 10}{0.5}$

$= 20\pi \times 10^{-4}$

$B = 6.28 \times 10^{-3}$ T

Question ID: 7029011

Two long parallel conductors separated by a certain distance 'd' and carrying steady currents I_1 and I_2 are shown in figures. Choose the correct statement.

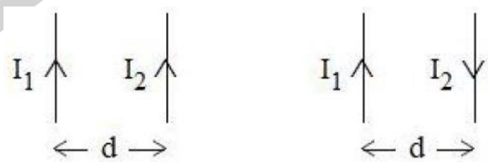


Figure - 1 Figure - 2

(A) In figure-1 conductors repel each other and in figure-2 they attract each other

(B) In figure-1 conductors attract each other and in figure-2 they repel each other

(C) In both the figures conductors attract each other

(D) In both the figures conductors repel each other

Answer (B)

Sol. When current in the wire are in same direction they experience an attractive force and when they carry current in opposite direction, they experience repulsive force.

Question ID: 7029012

Which of the following statements related to magnetic materials are correct?

A. Diamagnetic materials get strongly magnetized in an external magnetic field.

B. Ferromagnetic materials get strongly magnetized in an external magnetic field.

C. Paramagnetic materials get weakly magnetized in an external magnetic field.

D. Soft iron is a suitable materials for the core of electro-magnets.

E. For diamagnetic materials, magnetic susceptibility is positive and small.

Choose the correct answer from the options given below:

(A) A, B, E only (B) B, C, E only

(C) B, C, D only (D) C, D, E only

Answer (C)

Sol. Paramagnetic materials get feeble magnetisation in the same sense as applied field.

Diamagnetic materials get feeble magnetisation in opposite direction of applied field.

Ferromagnetic materials get strongly magnetised by magnetic field.

Soft iron inside the coil makes magnetic field stronger for diamagnetic, $\chi_m < 0$.

Question ID: 7029013

In a solenoid, if number of turns per unit length is doubled, then self inductance will become:

(A) Half of its initial value

(B) Double of its initial value

(C) $\frac{1}{4}$ times of its initial value

(D) 4 times of its initial value

Answer (D)

Sol. Coefficient self inductance is directly proportional to square of number of turns in coil.

$\therefore$ Doubling number of turns coefficient of self inductance becomes 4 times.

Question ID: 7029014

The current in a coil falls from 5.0 to 0.0 A in 0.1 s. If average emf of 200 V is induced, the value of self inductance of coil is

(A) 2 H (B) 4 H

(C) 3 H (D) 1 H

Answer (B)

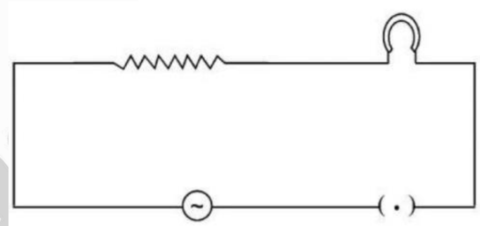
Sol. $|E| = L\left|\frac{dI}{dt}\right|$

$$\left|\frac{dI}{dt}\right| = \frac{0-5}{0.1} = |-50\text{ A/s}| = 50\text{ A/s}$$

$$L = \frac{200}{50} = 4\text{ H}$$

Question ID: 7029015

A bulb and an iron core inductor are connected to an AC source through key as shown in figure



The bulb glows with certain brightness. Now iron rod in taken out of the inductor. Then the brightness of bulb.

(A) Increases

(B) Decreases

(C) Is unchanged

(D) First increases then decreases

Answer (A)

Sol. When iron rod is removed it reduces the permeability of core of inductor and thus inductance decreases

$[L = \mu_0\mu_r n^2 lA]$: initially

$[L' = \mu_0 n^2 lA]$: later

Then, $X_L = \omega L$ decrease

and hence, $Z = \sqrt{R^2 + (\omega L)^2}$ decreases resulting in increase in current in the circuit

Thus, brightness of bulb increases

Question ID: 7029016

Match List I with List II

List I (Physical quantity)	List II (SI unit)
A. Self-Inductance	I. Weber
B. Magnetic	II. Volt
C. Impedance	III. Henry
D. Induced emf	IV. Ohm

Choose the correct answer from the options given below.

(A) A-III, B-I, C-II, D-IV (B) A-III, B-I, C-IV, D-II

(C) A-I, B-III, C-IV, D-II (D) A-I, B-III, C-II, D-IV

Answer (B)

Sol. A-III, B-I, C-IV, D-II

Question ID: 7029017

A 50 Ω resistance and an inductance of $\frac{2}{3\pi}$H are connected in series with power supply of 220 volt AC of 50 Hz. Choose the correct statement.

(A) Current leads the potential difference by $\tan^{-1}\left(\frac{3}{4}\right)$

(B) Potential difference leads the current by 90°

(C) Current leads the potential difference by $\tan^{-1}\left(\frac{4}{3}\right)$

(D) Potential difference leads the current by $\tan^{-1}\left(\frac{4}{3}\right)$

Answer (D)

Sol. $\phi = \tan^{-1}\left(\frac{\omega L}{R}\right)$

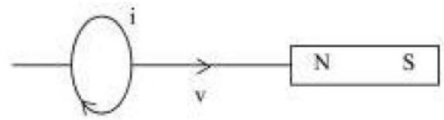
$$= \tan^{-1}\left(\frac{2\pi fL}{R}\right)$$

$$= \tan^{-1}\left(\frac{2\times\pi\times 50\times 2}{50\times 3\pi}\right)$$

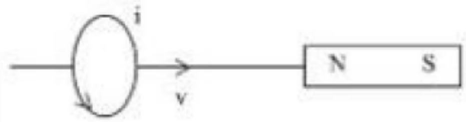
$$\phi = \tan^{-1}\left(\frac{4}{3}\right)$$

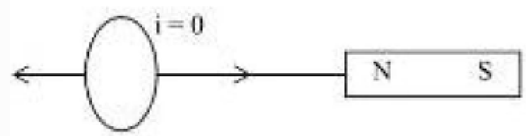
Question ID: 7029018

Given figures shows a plane coil in moving with velocity *v* with respect to N-pole of a bar magnet. The correct interpretation of induced current is given in figure.

(A) 

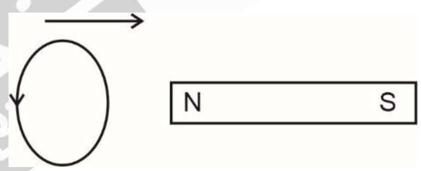
(B) 

(C) 

(D) 

Answer (C)

Sol. Lenz's Law



Question ID: 7029019

The electromagnetic waves which can be used to destroy cancer cells are

A. Ultraviolet Rays B. Gamma Rays

C. Infrared Rays D. X-Rays

E. Microwaves

Choose the correct answer from the options given below

(A) A, B and E only (B) B and D only

(C) C, D and E only (D) A and E only

Answer (B)

Sol. Gamma rays and X-rays are dominantly used in medicines to destroy the cells that are cancer affected.

Question ID: 7029020

Two Electromagnetic waves have the frequencies as 4×10^{14} Hz and 8×10^{14} Hz. The ratio of their speeds in air is

(A) 1 : 2 (B) 1 : 4

(C) 1 : 1 (D) 2 : 1

Answer (C)

Sol. Speed of electromagnetic waves remains same in air i.e., 3×10^8 m/s

$\therefore$ Ratio of speed = 1 : 1

Question ID: 7029021

A beam of light consisting of two wavelengths 5000 Å and 6000 Å is used to obtain interference fringes in Young's double slit experiment. The least distance from the central maxima, ·here the bright fringes due to both wavelengths coincide, will be

(If separation between slits = 1 mm and separation between slits and screen is 1 m)

(A) 4 mm (B) 3 mm

(C) 2 mm (D) 1 mm

Answer (B)

Sol. Let nth bright fringe of 5000 Å wavelength coincides with $(n-1)^{th}$ bright fringe of 6000 Å

$\therefore \quad n \times 5000 = (n-1)6000$

$5n = 6n - 6$

$n = 6$

least distance from central maxima

$$x' = n\lambda_1 \frac{D}{d} = 6 \times 5000 \times \frac{1 \times 10^{-10}}{1 \times 10^{-3}}$$

$x' = 30 \times 10^{-4}$ m = 3 mm

Question ID: 7029022

In an interference pattern, the ratio of intensity of waves is $\frac{9}{25}$, then the ratio of maximum intensity to minimum intensity is :

(A) 16 : 1

(B) 1 : 9

(C) 3 : 5

(D) 5 : 3

Answer (A)

Sol. $\frac{I_1}{I_2} = \frac{9}{25}$

$$\frac{I_{max}}{I_{min}} = \left(\frac{\sqrt{I_1} + \sqrt{I_2}}{\sqrt{I_1} - \sqrt{I_2}}\right)^2$$

$$= \left(\frac{3+5}{3-5}\right)^2 = \left(\frac{8}{(-2)}\right)^2 = \frac{64}{4}$$

$I_{max} : I_{min} = 16 : 1$

Question ID: 7029023

Which of the following statements are true: For refraction of white Light through a glass prism at minimum deviation position of prism.

A. The angle of prism becomes zero.

B. Angle, of refraction at first refracting surface r 1 is equal to angle of refraction at second refracting surface r2.

C. The refracted ray inside the prism. is parallel to the base of the prism.

D. Angle of emergence becomes 90°

E. Angle of incidence. is equal to angle of emergence.

Choose the coffed answer from the options given below:

(A) B, C and E only

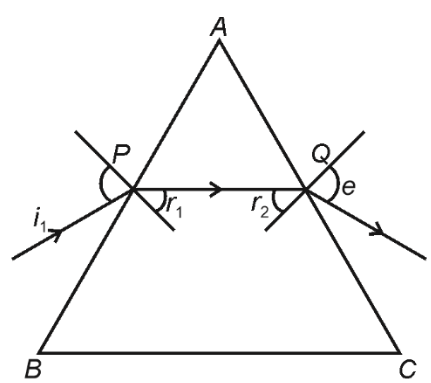
(B) A, C and D only

(C) B, C and D only

(D) A, D and E only

Answer (A)

Sol. Condition for minimum deviation for prism



(1) $i_1 = e$

(2) $r_1 = r_2$

(3) $PQ || BC$

Question ID: 7029024

A convex lens of refractive index 1.55, with both the surfaces of the same radius of curvature has a focal length of 20 cm. The radius of curvature of the surface, will be:

(A) 20 cm (B) 22 cm

(C) 24 cm (D) 26 cm

Answer (B)

Sol. $\frac{1}{f}=(\mu-1)\left[\frac{1}{R_1}-\frac{1}{R_2}\right]$

$\frac{1}{f}=(\mu-1)\left[\frac{1}{R}+\frac{1}{R}\right]$ $R_1 = R$, $R_2 = -R$

$\frac{1}{f}=\frac{2(\mu-1)}{R}$

$\frac{1}{20}=\frac{2\times0.55}{R}\Rightarrow R=2\times0.55\times20$

R = 22 cm

Question ID: 7029025

Match List I with List II

	List I		List II
A.	Convex mirror	I.	Accommodation
B.	Total Internal Reflection	II.	Reflecting type
C.	Cilliary muscles	III.	Optical Fiber
D.	Cassegrain Telescope	IV.	Used as a rear view mirror

Choose the correct answer from the options given below

(A) A-IV, B-I, C-III, D-II

(B) A-IV, B-III, C-I, D-II

(C) A-II, B-III, C-I, D-IV

(D) A-I, B-III, C-IV, D-II

Answer (B)

Sol. Cassegrain telescope is used as a parabolic reflector

T.I.R $\rightarrow$ occurs in optical fibre.

Cilliary muscles performs process of focusing called accommodation.

Convex mirror is used as rear view mirror

Question ID: 7029026

Match List I, with Li.st II

	List I		List II
A.	Double Convex Mirror	I.	$f=\frac{R}{\left(1-n_g^a\right)}$
B.	Plane Convex Lens	II.	$f=\frac{R}{2\left(n_g^a-1\right)}$
C.	Double Concave Lens	III.	$f=\frac{R}{\left(n_g^a-1\right)}$
D.	Plano Concave Lens	IV.	$f=\frac{R}{2\left(1-n_g^a\right)}$

Choose the correct answer from the options given below:

(A) A-II, B-I, C-IV, D-III

(B) A-II, B-III, C-IV, D-I

(C) A-II, B-III, C-I, D-IV

(D) A-IV, B-III, C-II, D-I

Answer (B)

Sol. Double convex lens

$\frac{1}{f}=(\mu-1)\left[\frac{1}{R_1}-\frac{1}{R_2}\right]$

$\frac{1}{f}=(\mu-1)\left[\frac{1}{R}+\frac{1}{R}\right]$

$\frac{1}{f}=(\mu-1)\frac{2}{R}$

$f=\frac{R}{2(\mu-1)}$

A – II

Plano convex

$\frac{1}{f}=(\mu-1)\left[\frac{1}{R}-\frac{1}{\infty}\right]$

$\frac{1}{f}=(\mu-1)\left[\frac{1}{R}\right]$

$f=\frac{R}{(\mu-1)}$

B = III

Double concave lens

$$\frac{1}{f}=(\mu-1)\left[\frac{1}{-R}-\frac{1}{R}\right]$$

$$\frac{1}{f}=-(\mu-1)\frac{2}{R}$$

$$f=-\frac{R}{2(\mu-1)}$$

$$f=\frac{R}{2(1-\mu)}$$

C = IV

D = I

Question ID: 7029027

In Young's double slit experiment using monochromatic light of wavelength λ, the intensity of light at a point on the screen where path difference λ is K units. What is the intensity of light at a point where path difference is $\frac{\lambda}{3}$?

(A) $\frac{K}{6}$ (B) $\frac{K}{4}$

(C) $\frac{K}{2}$ (D) $\frac{K}{8}$

Answer (B)

Sol.

$$I_0 = K$$

$$I_\lambda = I_0\cos^2\left(\frac{\phi}{2}\right)$$

$$I'_{\frac{\lambda}{3}} = K\cos^2\left(\frac{2\pi}{3\times 2}\right)$$

$$I'=\frac{K}{4}$$

$$\phi=\frac{2\pi}{\lambda}\Delta x$$

$$=\frac{2\pi}{\lambda}\times\frac{\lambda}{2}=\frac{2\pi}{3}$$

Question ID: 7029028

The interference pattern is said to be sustained if the position and intensity of fringes remain same throughout on the screen. For sustained interference:

A. The size of slits must be large.

B. Two sources must be coherent.

C. Screen must be very close to slits.

D. Separation between the slits must be small

E. The screen must be placed close the plane of slits.

Choose the correct answer from the options given below:

(A) A and C only (B) B only

(C) B and D only (D) B, D and E only

Answer (C)

Sol. Conditions for sustained interference

1. The two sources of light must be coherent with same frequency or wavelength and with same phase or constant phase difference.
2. The two sources must be very close to each other.

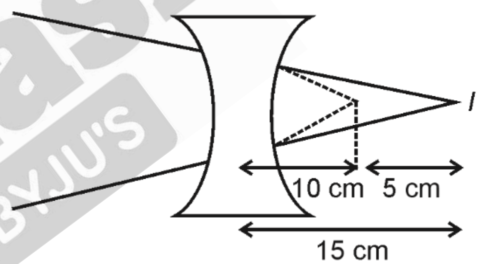
Question ID: 7029029

A converging beam of rays is incident on a concave lens. After passing through the lens, the rays converge at a distance of 15 cm from the lens on the other side. If the lens is removed, the converging point of rays decreases by 5 cm. The focal length of lens is

(A) –10 cm (B) –20 cm

(C) –30 cm (D) –5 cm

Answer (C)



Sol.

$$\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$$

$$\frac{1}{15}-\frac{1}{10}=\frac{1}{f}$$

$f = -30$ cm

Question ID: 7029030

The Kinetic Energy of an electron having de Broglie wavelength triple, then the de Broglie wavelength associated with it becomes:

(A) $\frac{\lambda}{3}$ (B) $\lambda\sqrt{3}$

(C) $\frac{\lambda}{\sqrt{3}}$ (D) 3λ

Answer (C)

Sol. $\lambda_{\text{de-Broglie}}=\frac{h}{\sqrt{2mK}}$

$$\lambda \propto \frac{1}{\sqrt{K}}$$

K.E. tripled

$$\frac{\lambda_1}{\lambda_2} = \frac{\sqrt{3K}}{\sqrt{K}}$$

$$\frac{\lambda_1}{\lambda_2} = \sqrt{3}$$

$$\lambda_2 = \frac{\lambda_1}{\sqrt{3}}$$

$$\therefore \quad \lambda_{\text{de-Broglie}} = \frac{\lambda}{\sqrt{3}}$$

Question ID: 7029031

Identify the correct statement according to Einstein's picture of photoelectric effect:

(A) Maximum Kinetic Energy of electrons depends linearly on frequency of incident radiation

(B) Maximum Kinetic Energy of electrons depends linearly on intensity of incident radiation

(C) The photoelectric current is independent of intensity of incident radiation

(D) Intensity of incident radiation is directly proportional to the frequency of radiation

Answer (A)

Sol. (A) $(K)_{max} = h\nu - \phi_0$

$y = mx - C$

linear variation.

(B) K.E. is independent of intensity of given source.

(C) If intensity ↑↑, no. of photons ↑↑, no. of e^{-s} emitted ↑↑

∴ Saturation current ↑↑.

(D) Intensity of incident radiation is directly proportional to frequency of radiation.

Question ID: 7029032

According to photon picture of electromagnetic radiation, which of the following statements is incorrect?

(A) Each photon has energy and momentum

(B) Each photon moves with speed of light in vacuum

(C) Photons are electrically neutral

(D) In a photon-electron collisions, the total energy and total momentum are not conserved

Answer (D)

Sol. In case of photon-electron collision momentum and energy is conserved.

Question ID: 7029033

The relation between half-life of a radio nuclide denoted by $T_{\frac{1}{2}}$ and average life of a radio nuclide denoted by τ, is:

(A) $T_{\frac{1}{2}} = \tau \ln 2$

(B) $\tau = T_{\frac{1}{2}} \ln 2$

(C) $T_{\frac{1}{2}} = \frac{1}{\tau}$

(D) $T_{\frac{1}{2}} = \tau$

Answer (A)

Sol. $T_{\frac{1}{2}} = \frac{\ln 2}{\lambda}$

$\tau = \frac{1}{\lambda}$

$T_{\frac{1}{2}} = \tau \ln 2$

Question ID: 7029034

Arrange the following steps involved in working of photodiode in sequential order of their occurrence

A. Electron hole pair generation

B. Absorption of photons

C. Illumination with light

D. Separation of electron-hole pair

E. Collection of electrons in n-side and holes in p-side.

Choose the correct answer from the options given below:

(A) D, E, B, A, C (B) C, B, A, D, E

(C) C, A, D, B, E (D) B, C, A, D, E

Answer (B)

Sol. The correct order is option B

Question ID: 7029035

For a Common-Emitter amplifier, the audio signal voltage across the collector resistance of 2 kΩ is 2 V. Suppose the current amplification factor of the transistor is 100. The base resistance is 1 kΩ. The input signal voltage will be:

(A) 0.02 V (B) 0.04 V

(C) 0.03 V (D) 0.01 V

Answer (D)

Sol. $R_C = 2\ k\Omega$

$V_0 = 2V$

$R_B = 1\ k\Omega$

$\beta = 100$

$V_{in} = I_B R_B$

$$V_{in} = \frac{I_C R_B}{\beta}$$

$$I_B = \frac{I_C}{\beta}$$

$$I_B = \frac{V_C}{R_C\beta} = \frac{2}{2000 \times 100} = 10\ \mu A$$

Input voltage

$= I_B R_B$

$= 10 \times 10^{-6} \times 10^3$

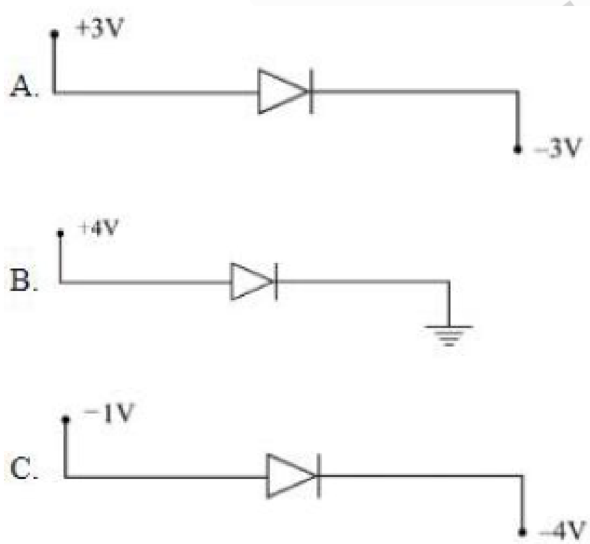
$= 10\ mV$

$= 10 \times 10^{-3}$

$= 0.01\ V$

Question ID: 7029036

Choose the correct answer from the following options:



(A) Only diode A is in forward biasing.

(B) Just two diodes A and B are in forward biasing.

(C) All diodes A, B and C are in forward biasing.

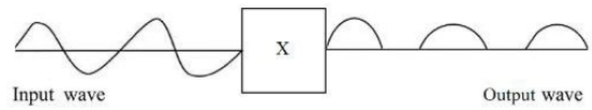
(D) None of the diodes A, B and C are in forward biasing.

Answer (C)

Sol. In all cases *p*-side is at high potential than n-side, hence. All are forward biased

Question ID: 7029037

The following figures shows device *X* with input and output signals. The device is:



(A) Half wave Rectifier

(B) Full wave Rectifier

(C) Transistor

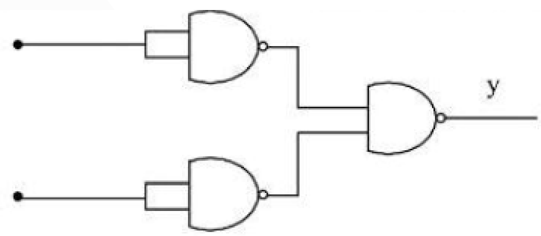
(D) Transformer

Answer (A)

Sol. In output only positive cycle is present, hence. It is a half wave rectifier as per O/p signal

Question ID: 7029038

Choose the logic operation for the following circuits:



(A) OR

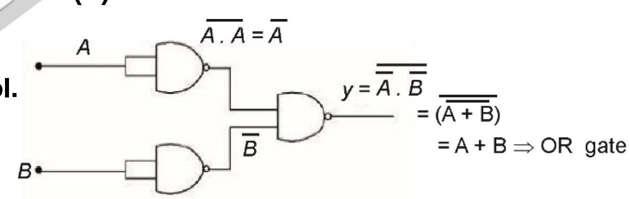
(B) AND

(C) NOR

(D) NAND

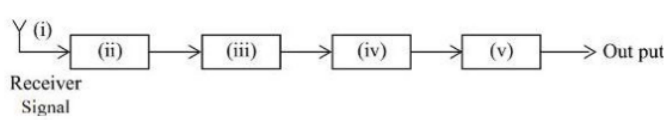
Answer (A)

Sol.



Question ID: 7029039

A block diagram of a typical receiver in a communication system is as shown in figure. The various components in correct sequence is



A. Detector

B. Amplifier 1

C. IF stage

D. Amplifier 2

E. Receiving Antenna

Choose the correct answer from the options given below:

(A) (i)-E, (ii)-B, (iii)-D, (iv)-C, (v)-A

(B) (i)-E, (ii)-B, (iii)-C, (iv)-A, (v)-D

(C) (i)-E, (ii)-D, (iii)-A, (iv)-B, (v)-C

(D) (i) -E, (ii)-A, (iii)-B, (iv)-C, (v)-D

Answer (B)

Sol. Amplifier → IF stage → Detector → Amplifier → O/P

(A) Receiving Antenna	(i) E
(B) Amplifier 1	(ii) B
(C) IF stage	(iii) C
(D) Detector	(iv) A
(E) Amplifier 2	(v) D

Question ID: 7029040

In the detection of amplitude modulated wave, the carrier frequency is usually changed to a long frequency by

(A) Amplifier (B) Detector

(C) IF stage (D) Receiving Antenna

Answer (C)

Sol. IF stage

Passage:

We are introduced to the Bohr model of atom one time or the other in the course of physics. This model has its place in the history of quantum mechanics and particularly in explaining the structure of an atom. It has become a milestone since Bohr introduced the revolutionary idea of definite energy orbits for the electrons, contrary to the classical picture requiring an accelerating particle to radiate. Bohr also introduced the idea of quantisation of angular momentum of electrons moving in definite orbits. Thus, it was a semi-classical picture of the structure of atom.

Now with the development of quantum mechanics, we have a better understanding of the structure of atom. Solutions of the Schrodinger wave equation assign a wave-like description to the electrons bound in an atom due to attractive forces of the protons.

An orbit of the electron in the Bohr model is the circular path of motion of an electron around the nucleus.

- Bohr model is valid only for one-electron atom/ions; an energy value, assigned to each orbit, depends on the principal quantum number *n* in this model. We know that energy associated with a stationary state of an electron depends on *n* only. For one-electron atoms/ions. For a multi-electron atom/ion, this is not true.

Question ID: 7029041

According to Bohr postulates, wavelength of spectral lines can't be determined for

(A) Na

(B) Li^{++}

(C) He^{+}

(D) H

Answer (A)

Sol. Bohr's postulates only apply to hydrogen and hydrogen like ions, like H, He^{+}, Li^{2+}.

Na is incorrect

Question ID: 7029042

Bohr's quantisation conditions

(A) Charge is quantised

(B) Angular momentum is quantised

(C) Circumference of electron orbit is quantised

(D) Energy is quantised

Answer (B)

Sol. Acc. to Bohr's quantisation condition:

Angular momentum of an e^- in an orbit around the H-atom has to be an integral multiple of $\frac{h}{2\pi}$

$$L \propto \frac{h}{2\pi}$$

Question ID: 7029043

Ground state energy of electron in Hydrogen atom is –13.6 eV De-Broglie wavelength of electron in 2nd excited state is

(A) 13.6 Å

(B) 3.77 Å

(C) 3.18π Å

(D) 9.54π Å

Answer (C)

Sol. 3.18π Å

Question ID: 7029044

Bohr's model of atom is

(A) Classical picture of atomic structure

(B) Semi-classical picture of atomic structure

(C) Quantum picture of atomic structure

(D) Standing wave picture of atomic structure

Answer (C)

Sol. Bohr's model of atom is quantum picture of atomic structure which proposed quantised energy levels.

Question ID: 7029045

In the Hydrogen Spectrum provided by Bohr's model, spectral series falls in ultra-violet region of E.M. wave is :

(A) Lyman series (B) Balmer series

(C) Paschen series (D) Brackett series

Answer (A)

Sol. The spectral series in UV region is lyman series of hydrogen

Balmer $\rightarrow$ visible

Paschen $\rightarrow$ near infrared

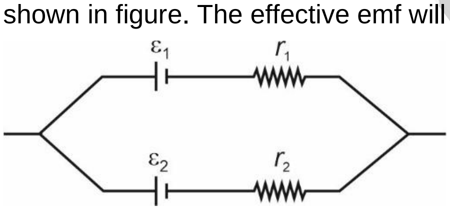
Pfund $\rightarrow$ For infrared

Passage:

A cell is a source of electric current in the electrical circuit. The Potential difference between terminals of a cell in an open circuit (when no current is drawn) is called electromotive force (emf) of the cell. When electrical circuit is closed and current is drawn from the terminal potential difference between two terminals is called terminal potential difference (v) of the cell. The cells can be connected in series as well as in parallel combinations. Like resistor cell also offers opposition to the flow of current. This opposition offered by cell is called internal resistance of the cell.

Question ID: 7029046

Two cells of emf's ε_1 and ε_2 and respective internal resistances r_1 and r_2 are connected in parallel as shown in figure. The effective emf will be :



(A) $\dfrac{\varepsilon_1 r_1 + \varepsilon_2 r_2}{r_1 + r_2}$

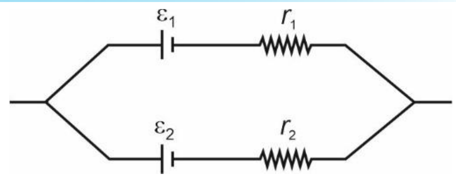
(B) $\dfrac{\varepsilon_1 r_2 + \varepsilon_2 r_1}{r_1 + r_2}$

(C) $\dfrac{\varepsilon_1 r_2 - \varepsilon_2 r_1}{r_1 - r_2}$

(D) $\dfrac{\varepsilon_1 r_1 - \varepsilon_2 r_2}{r_1 + r_2}$

Answer (B)

Sol. Terminal P.D across I = $\varepsilon_1 - I_1 r_1 = V$



$$I_1 = \frac{\varepsilon_1 - V}{r_1}$$

Terminal P.D. across II $\Rightarrow V = \varepsilon_2 - I_2 r_2$

$$I_2 = \frac{\varepsilon_2 - V}{r_2}$$

I be current flowing through cell

$I = I_1 + I_2$

$$I = \frac{\varepsilon_1 - V}{r_1} + \frac{\varepsilon_2 - V}{r_2}$$

$$I_1 = \frac{\varepsilon_1 r_2 + \varepsilon_2 r_1 - V(r_1 + r_2)}{r_1 r_2}$$

$I_1(r_1 r_2) = \varepsilon_1 r_2 + \varepsilon_2 r_1 - V(r_1 + r_2)$

$$V = \frac{\varepsilon_1 r_2 + \varepsilon_2 r_1}{r_1 + r_2} - \frac{I r_1 r_2}{r_1 + r_2}$$

Comparing with $V = \varepsilon - I_r$

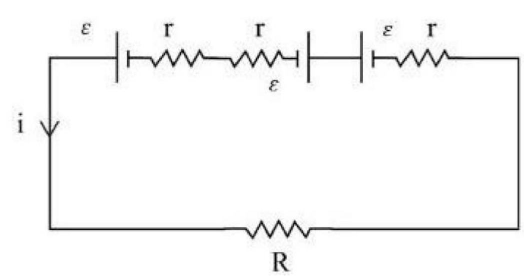
ε = Effective emf

$$= \frac{\varepsilon_1 r_2 + \varepsilon_2 r_1}{r_1 + r_2}$$

$$R_{\text{eff}} = \frac{r_1 r_2}{r_1 + r_2}$$

Question ID: 7029047

Three cells, each of emf ε and internal resistance r are connected with external resistor R as shown in fig. The value of current (i) flowing in the circuit will be :



(A) $\dfrac{3\varepsilon}{R + 3r}$ (B) $\dfrac{2\varepsilon}{R + r}$

(C) $\dfrac{\varepsilon}{R + 3r}$ (D) Zero

Answer (C)

Sol. $i = \dfrac{\varepsilon}{R + 3r}$

Question ID: 7029048

When a cell is connected across external resistance 5 Ω, a current of 0.25 A flows through the circuit. If the external resistance is replaced by 2 Ω, a current of 0.5 A flows through it. The emf of the cell in the circuit is :

(A) 0.75 V

(B) 1 V

(C) 1.25 V

(D) 1.5 V

Answer (D)

Sol. $E = I(R + r)$

$I = 0.25$ A, $R = 5\ \Omega$

Emf = V

$V = 0.25\ (5 + r)$

$V = \dfrac{1}{4}(5 + r)$

$4V = 5 + r$ ...(1)

$I = 0.5$ A, $R = 2\ \Omega$

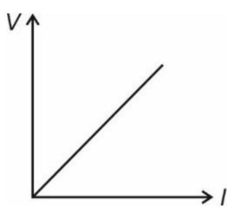
$V = 0.5\ (2 + r) \Rightarrow 2V = 2 + r$ ...(2)

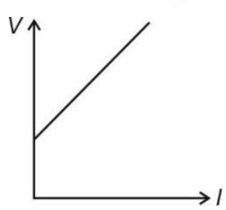
From (1) and (2)

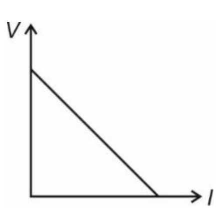
$V = 1.5$ V

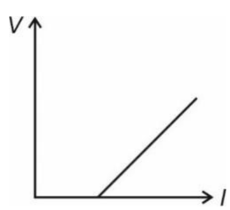
Question ID: 7029049

The variation of terminal potential difference of a cell with current drawn from the cell is correctly represented by :

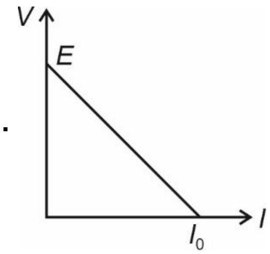
(A) 

(B) 

(C) 

(D) 

Answer (C)

Sol. 

$V = E - Ir$

$r = \dfrac{E - V}{I}$

At $I = 0$

$V = E$

$I = I_0$, $V = 0$

$0 = E - I_0 r$

$r = \dfrac{E}{I_0}$

Question ID: 7029050

Two identical cells each of emf ε and internal resistance r when connected in series or in parallel across external resistance R give the same value of current. Then the relation between r and R is

(A) $r = R$

(B) $r = 2R$

(C) $r = \dfrac{R}{2}$

(D) $r = \dfrac{3R}{2}$

Answer (A)

Sol. $\dfrac{nE}{R + nr} = \dfrac{nE}{nR + r}$

R = external resistance

r = Internal resistance

$R + nr = nR + r$

$nR - R = nr - r$

$R(n - 1) = r(n - 1)$

$R = r$

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