08/08/2022

Slot-1

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Answers & Solutions

for

CUET UG-2022

(Physics)

Time : 45 min.

M.M. : 200

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: 702861

Two charges in air experience a force of 20 N. If the space between them is filled with a medium of dielectric constant K = 4, the new force will be

(A) 20 N (B) 5 N

(C) 4 N (D) 2 N

Answer (B)

Sol. We know, $K = \frac{\varepsilon}{\varepsilon_0}$

and in case of medium, $F' = \frac{1}{4\pi\varepsilon}\left(\frac{Q_1Q_2}{r^2}\right)$, $\varepsilon = K\varepsilon_0$

$$\Rightarrow F' = \frac{1}{4\pi K\varepsilon_0}\left(\frac{Q_1Q_2}{r^2}\right) \Rightarrow F' = \frac{F}{4} = \frac{20}{4} = 5\text{ N}$$

Question ID: 702862

Statement I: Speed of a negatively charged particle decreases while moving in the direction of an electric field.

Statement II: A positively charged particle moving in the direction of an electric field experience acceleration.

In the light of the above statement, choose the correct answer from the options given below.

(A) Both statement **I** and statement **II** are true

(B) Both statement **I** and statement **II** are false

(C) Statement **I** is true but statement **II** is false

(D) Statement **I** is false but statement **II** is true

Answer (A)

Sol. As the force on the electron due to external electric field acts in opposite direction to the electric field hence when electron moves in the direction of electric field its speed decreases.

The force on the proton due to external electric field is in the same direction of the electric field hence it experiences acceleration.

Question ID: 702863

Which one of the following statement is wrong?

(A) Electric field lines start from positive charges and end at negative charges

(B) In a charge free region, electric field lines can be taken to continuous without any breaks

(C) Two field lines never cross each other

(D) Electrostatic field lines form closed loops.

Answer (D)

Sol. $\Rightarrow$ Electrostatic field lines doesn't form closed loops.

$\Rightarrow$ Hence the fourth statement is wrong among the given statements.

Question ID: 702864

Select the correct statement from the following

A. Gauss's law is true for any closed surface, no matter what its shape or size.

B. If the net electric flux through a closed surface is zero, we can conclude that the total charge contained in the closed surface is also zero.

C. Gauss's law is not based on the inverse square dependence on distance contained in the coulomb's law.

D. The electric field due to a charge outside the Gaussian surface contributes zero net flux through the surface.

Choose the correct answer from the options given below

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

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

Answer (C)

Sol. Gauss law is true for any closed surface, no matter what its shape or size is. If net electric flux through a closed surface is zero then total charge enclosed by the closed surface would also be zero.

The contribution of the charges outside the closed surface in producing the flux is zero.

Gauss's law is based on the inverse square dependence on distance contained in coulomb's law.

Hence statement C is wrong and A, B and D is correct.

Question ID: 702865

A slab of material of dielectric constant K has the same area as the plates of a parallel plate capacitor but has a thickness $\left(\frac{1}{4}\right)d$ and placed between plates of parallel plate capacitor, where d is the separation of the plates. The ratio of capacitances of capacitor with dielectric and with air as medium $\left(\frac{c}{c_0}\right)$ is

(A) $\frac{3K+1}{4K}$ (B) $\frac{4K}{3K+1}$

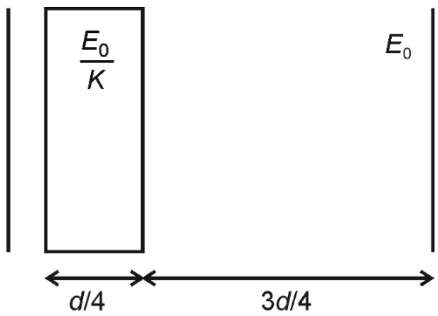
(C) $\frac{K}{3K+1}$ (D) $\frac{4K}{K+3}$

Answer (B)

Sol. When air was medium between plates of capacitor,

$$C_0 = \frac{A\varepsilon_0}{d}$$

When dielectric was filled



$$V = \frac{E_0}{K}\times\frac{d}{4} + E_0\times\frac{3d}{4} \text{ and } E_0 = \frac{Q}{A\varepsilon_0}$$

$$\Rightarrow V = \frac{Qd}{4A\varepsilon_0}\left[\frac{1}{K}+3\right]$$

$$\Rightarrow V = \frac{Qd}{4A\varepsilon_0}\left[\frac{1+3K}{K}\right] \text{ and } Q = V\times\frac{4A\varepsilon_0 K}{d(1+3K)} \text{ also}$$

$Q = CV$

$$\Rightarrow C = \frac{4A\varepsilon_0 K}{d(1+3K)} \text{ and } C_0 = \frac{A\varepsilon_0}{d} \Rightarrow \frac{C}{C_0} = \frac{4K}{1+3K}$$

Question ID: 702866

Charged bodies are considered as point charges if the linear size of the charged bodies is

(A) Much smaller than the separation between them

(B) Greater than the separation between them

(C) Equal to the separation between them

(D) Independent of separation between them

Answer (A)

Sol. Charged bodies are considered as point charges if linear size of the charged bodies is much smaller than the separation between them.

Question ID: 702867

Resistivity of copper, nichrome and a semiconductor varies with temperature respectively as

(A) Linear, exponential increase and exponential decrease

(B) Exponential increase, linear and exponential decrease

(C) Exponential increase, exponential decrease and linear

(D) Linear, exponential decrease and exponential increase

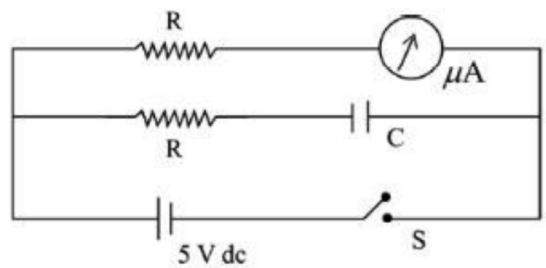
Answer (B)

Sol. For Copper → exponential increase

For Nichrome → linear increase

For Semiconductor → exponential decrease

Question ID: 702868



?

Two resistances of same value, one capacitor and one micro ammeter is connected to a 5V battery of negligible internal resistance and a switch (s) as shown in the figure. When the switch is closed the micro ammeter shows a reading of 20 μA.

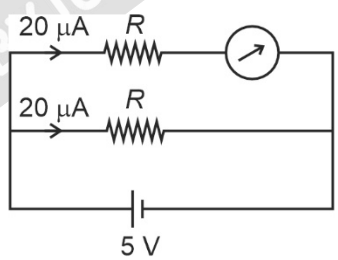
The value of R is

(A) 250 kΩ (B) 250 Ω

(C) 25 kΩ (D) 250 MΩ

Answer (A)

Sol. At the time switch is closed capacitor behaves like a closed switch



⇒ equivalent circuit

$$\Rightarrow \frac{5}{R} = 20\times10^{-6}$$

$\Rightarrow R = 250\ \text{k}\Omega$

Question ID: 702869

The drift velocity of electrons is 2×10^{-6} m/s in a conductor in which the number of free electrons is 6×10^{28} per m^3. If the cross section of the conductor is 5×10^{-4} m^2, then the current flowing through the conductor is

(Given $e = 1.6 \times 10^{-19}$ coul)

(A) 96 Amp (B) 48 Amp

(C) 9.6 Amp (D) 4.8 Amp

Answer (C)

Sol. We know,

$i = neAV_d \Rightarrow i = 6 \times 10^{28} \times 1.6 \times 10^{-19} \times 5 \times 10^{-4} \times 2 \times 10^{-6}$

$\Rightarrow \ i = 6 \times 1.6 \times 10 \times 10^{28} \times 10^{-29} = 9.6$ A

Question ID: 7028610

The amount of the charge passed in time t through a cross-section of a wire is $Q_t = At^2 + Bt + C$. If the value of A, B, C in SI units respectively are 5, 3, 1 the value of current at $t = 5$ s is

(A) 66 A (B) 70 A

(C) 53 A (D) 65 A

Answer (C)

Sol. $Q_t = At^2 + Bt + C$ and $A = 5$, $B = 3$, $C = 1$

$$\Rightarrow \ Q_t = 5t^2 + 3t + 1, \ i = \frac{dQ}{dt}$$

$\Rightarrow \ i = 10t + 3;\ (i)_{t=5} = 10 \times 5 + 3 = 53$ A

Question ID: 7028611

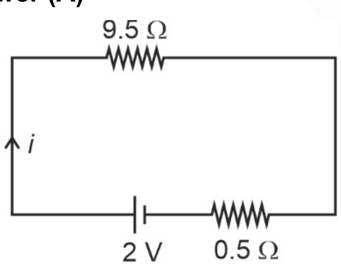
A battery of 2 V emf and internal resistance of 0.5 Ω is connected across a resistance of 9.5 Ω. The number of electrons passing through the resistance in 1 second.

(A) 1.25×10^{18} (B) 0.125×10^{18}

(C) 1.25×10^{19} (D) 12.5×10^{19}

Answer (A)

Sol.



$$\Rightarrow \ i = \frac{2}{9.5 + 0.5} \Rightarrow i = \frac{2}{10} = \frac{1}{5} \text{ A}$$

$$\Rightarrow \ n \times e = \frac{1}{5} \Rightarrow n = \frac{1}{5 \times 1.6 \times 10^{-19}} = 1.25 \times 10^{18}$$

Question ID: 7028612

Choose the wrong statement

(A) A bar magnet placed in a uniform magnetic field experience no force but experience torque

(B) In a non-uniform magnetic field a bar magnet experiences a force as well as a torque

(C) The potential energy is maximum when magnetic dipole moment $\vec{M}$ is parallel to magnetic field $\vec{B}$

(D) The work done in rotating a magnet in a uniform magnetic field from Q_1 to Q_2 is $W = MB(\cos\theta_1 - \cos\theta_2)$

Answer (C)

Sol. The potential energy is minimum when magnetic dipole moment $\vec{M}$ is parallel to magnetic field $\vec{B}$.

Hence statement C is wrong.

Question ID: 7028613

Ferromagnetic materials have

(A) The large and positive value of susceptibility

(B) The large and negative value of susceptibility

(C) The small and negative value of susceptibility

(D) Zero susceptibility

Answer (A)

Sol. Ferromagnetic materials have large and positive value of susceptibility.

Question ID: 7028614

Identify the diamagnetic substance

A. Bismuth

B. Aluminium

C. Platinum

D. Copper

E. Diamond

Choose the correct answer from the options given below:

(A) A, B and C only

(B) C, D and E only

(C) A, D and E only

(D) B, C and D only

Answer (C)

Sol. Among the given options, bismuth, copper and diamond are diamagnetic material.

Question ID:7028615

Find the magnetic field produced by a 5A current at the centre of a 50 turn coil of 8 cm diameter.

$$\text{Given, } \left(\mu_0 = 4\pi \times 10^{-7} \frac{\text{weber}}{amp.m}\right)$$

(A) 39.2×10^{-4} weber/m^2

(B) 36×10^{-4} weber/m^2

(C) 30×10^{-4} weber/m^2

(D) 26.2×10^{-4} weber/m^2

Answer (A)

Sol. Magnetic field at centre of coil $= \dfrac{\mu_0 \times i}{2R}$

$\Rightarrow$ Magnetic field due to 5A current at centre of a 50 turn coil of 8 cm diameter is $= \dfrac{50 \times \mu_0 \times i}{2R}$

$= \dfrac{50 \times 4\pi \times 10^{-7} \times 5}{2 \times 4 \times 10^{-2}}$ = 125 × π × 10^{-5}

= 392.6 × 10^{-5}

= 39.2 × 10^{-4} weber/m^2

Question ID:7028616

The force experienced by a current carrying wire placed in a magnetic field will be maximum when it is

(A) At an angle of 45° to the direction of magnetic field

(B) Parallel to the direction of magnetic field

(C) Anti-parallel to the direction of magnetic field

(D) Perpendicular to the direction of magnetic field

Answer (D)

Sol. $\vec{F} = i[\vec{\ell} \times \vec{B}]$

$\Rightarrow$ Force will be maximum when current carrying wire is placed perpendicular to magnetic field.

Question ID:7028617

Given below are two statements

Statement I : magnetic field does zero work on a charge particle entering with uniform velocity.

Statement II : A charge particle entering a region of uniform magnetic field with its velocity perpendicular to the direction of magnetic field, executes a circular motion.

In the light of the above statement, choose the most appropriate answer from the options given below

(A) Both statement I and statement II are correct

(B) Both statement I and statement II are incorrect

(C) Statement I is correct but statement II is incorrect

(D) Statement I is incorrect but statement II is correct

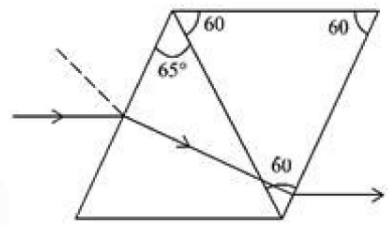
Answer (A)

Sol. $\Rightarrow$ The work done by magnetic field is zero on a charge particle entering with uniform velocity as displacement of particle is perpendicular to magnetic force.

A charge particle entering a region of uniform magnetic field with its velocity perpendicular to direction of magnetic field executes a circular motion.

Question ID:7028618

Two prism made of material of same refractive index and having angles of the prism 65° and 60° respectively are combined to form a glass block as shown. If for any ray passing across the block the minimum angle of deviation in 3° then refractive index for the material of the prism is



(A) 1.5 (B) 1.6

(C) 2.0 (D) 1.35

Answer (B)

Sol. According to the given question angle of minimum deviation is 3°

$\Rightarrow$ $(\mu - 1)A_1 - (\mu - 1)A_2 = 3$

$\Rightarrow$ $(\mu - 1)65 - (\mu - 1)\,60 = 3$

$\Rightarrow$ $65\mu - 65 - 60\mu + 60 = 3$

$\Rightarrow$ $5\mu - 5 = 3$

$\Rightarrow$ $5\mu = 8$

$\Rightarrow$ $\mu = 1.6$

Question ID:7028619

In Young's double slit experiment when light of wavelength 600 nm is used the fringe width is 0.1 mm. Calculate the fringe width when the entire apparatus is immersed in a medium of refractive index $\dfrac{4}{3}$ by keeping the source of light in air

(A) 0.01 mm (B) 1.05 mm

(C) 0.075 mm (D) 0.0075 mm

Answer (C)

Sol. Fringe width in air, $\beta = \dfrac{\lambda D}{d}$

Fringe width in liquid, $\beta' = \dfrac{\lambda D}{\mu d} = \dfrac{\beta}{\mu}$

$\Rightarrow$ $\beta' = \dfrac{0.1}{\frac{4}{3}} = 0.075$ mm

Question ID:7028620

Among the following which one is not due to the phenomenon of total internal reflection?

(A) Mirage

(B) Spectacular brilliance of diamond

(C) Optical fibers

(D) Dispersion of light

Answer (D)

Sol. Dispersion of light is not due to the phenomenon of total internal reflection.

Question ID: 7028621

An object is placed 12 cm in front of a convex mirror of focal length 18 cm, the value of the image distance is

(A) 18 cm (B) 12 cm

(C) 7.2 cm (D) 6 cm

Answer (C)

Sol. For, mirror, $\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$

We have been given a convex mirror, $\Rightarrow f = 18$ cm

$\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$ and f = 18 cm, $u = -12$ cm

$$\frac{1}{v}-\frac{1}{12}=\frac{1}{18} \Rightarrow \frac{1}{v}=\frac{1}{18}+\frac{1}{12}$$

$$\Rightarrow \frac{1}{v}=\frac{30}{12\times 18} \Rightarrow v = 7.2 \text{ cm}$$

Question ID: 7028622

A screen is placed 90cm from an object. The image of the object on the screen formed by a convex lens at two different locations separated by 20 cm. The focal length of the lens is

(A) 10.5 cm

(B) 15.4 cm

(C) 18.5 cm

(D) 21.4 cm

Answer (D)

Sol. If the distance between object and screen is D and distance between two positions of lens is x, then

$$f=\frac{D^2-x^2}{4D} \Rightarrow f=\frac{(90)^2-(20)^2}{4\times 90}=21.38 \text{ cm}$$

$\approx$ 21.4 cm

Question ID: 7028623

The resolution of a telescope where objective has a diameter of 200 inches when the light of wavelength 4000 Å is coming from the star is

(A) 9.606×10^{-8} rad (B) 96.06×10^{-8} rad

(C) 0.9606×10^{-8} rad (D) 9.006×10^{-4} rad

Answer (A)

Sol. The limit of resolution $\Delta\theta$ is given by

$\Delta\theta \approx \frac{0.61\lambda}{a}$, $\lambda = 4000 \times 10^{-10}$ m and a = 100 inches

$\Rightarrow$ $\lambda = 4000\times10^{-10}$ and a = 100 × 0.0254 = 2.54 m

$$\Delta\theta \approx \frac{0.61\times 4\times 10^{-7}}{2.54}=0.9606\times 10^{-7}$$

$\approx 9.606 \times 10^{-8}$ rad

Question ID: 7028624

The Brewster's angle for glass of refractive index 1.5 is

(A) 57.3° (B) 45°

(C) 60° (D) 67.3°

Answer (A)

Sol. Brewster's angle for glass of refractive index 1.5 is

$i = \tan^{-1}(\mu)$

$\Rightarrow$ $i = \tan^{-1}(1.5)$

$\Rightarrow$ i = 56.3°

$\Rightarrow$ The answer coming out is most close to option A i.e. 57.3°

Question ID: 7028625

A plane wavefront is incident on a thin convex lens. The nature of wavefront immediately after refraction is

(A) Plane wavefront

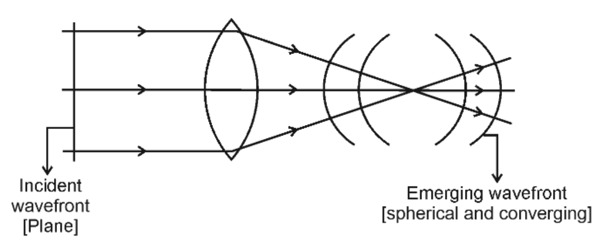
(B) Spherical and converging

(C) Spherical and diverging

(D) Cylindrical and diverging

Answer (B)

Sol.



Question ID: 7028626

The reddish appearance of the sun during sun rise and sunset is due to

(A) Wavelength of red light is more and hence its scattering is more

(B) Red light has higher energy and hence reaches our eyes even after travelling long distances

(C) Due to its. longer wavelength, its scattering is least hence travels longer and reach our eyes

(D) Because it does not follow Rayleigh scattering

Answer (C)

Sol. At sunrise and sunset rays pass through a larger distance through atmosphere so most of blue and other shorter wavelength are removed by scattering. The least scattered light reaches our eyes.

Amount of scattering $\propto \dfrac{1}{\lambda^4}$

Question ID: 7028627

A proton and an electron moving with same kinetic energy enter uniform magnetic field at right- angle to its direction. The ratio of radii of their trajectories will be:

(A) $\sqrt{2}:1$ (B) $1:\sqrt{2}$

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

Answer (NA)

Sol. $r = \dfrac{\sqrt{2m\,\text{K.E.}}}{qB}$, q is some for both electron and proton.

$$\Rightarrow r \propto \sqrt{m} \Rightarrow \frac{r_p}{r_e} = \sqrt{\frac{m_p}{m_e}} = \sqrt{\frac{1.67\times10^{-27}}{9.1\times10^{-31}}}$$

$$\Rightarrow \frac{r_p}{r_e} = \sqrt{\frac{m_p}{m_e}}$$

Question ID: 7028628

Ultraviolet light of wavelength 280 nm is used in an experiment on photoelectric effect with lithium whose work function is 2.5 eV as cathode. The stopping potential is (approximately)

(Take Planck's constant h and velocity of light c) and hc = 1242 eVnm

(A) 1.94 V (B) 41.9 V

(C) 441.5 V (D) 0.19 V

Answer (A)

Sol. $K_{max} = eV_0 = \dfrac{hC}{\lambda} - \phi_0$, $V_0 \rightarrow$ Stopping potential, $\phi_0 \rightarrow$ Work function

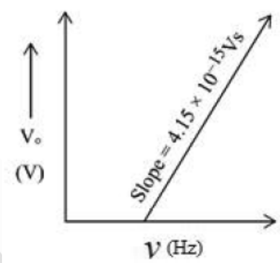
$$\Rightarrow eV_0 = \frac{1242}{280} - 2.5 \Rightarrow eV_0 = 1.9357 \text{ eV}$$

$\Rightarrow$ V_0 = 1.94 V

Question ID: 7028629

Consider the given graph between the stopping potential and frequency of incident light in an experiment of photoelectric effect. The slope of the graph gives:

(where symbols have their used meanings)



(A) h (B) $\dfrac{h}{e}$

(C) $\dfrac{\Phi}{e}$ (D) eh

Answer (B)

Sol. $eV_0 = hf - \phi_0$, $V_0 \rightarrow$ Stopping potential, $\phi_0 \rightarrow$ Work function

$$\Rightarrow V_0 = \left(\frac{h}{e}\right)f - \phi_0$$

$\Rightarrow$ Slope of graph obtained is h/e

Question ID: 7028630

The frequency of a photon of energy 2.3 eV emitted due to transition of electron from higher energy level to lower energy level is

(A) 555 × 10^{12} Hz

(B) 320 × 10^{10} Hz

(C) 555 × 10^{10} Hz

(D) 444 × 10^{12} Hz

Answer (A)

Sol. $hf = 2.3\times1.6\times10^{-19} \Rightarrow f = \dfrac{2.3\times1.6\times10^{-19}}{6.62\times10^{-34}}$

$\Rightarrow$ f = 0.55589 × 10^{15} Hz ≈ 555 × 10^{12} Hz

Question ID: 7028631

In a Geiger Marsden experiment, an alpha particle of energy 6 meV hits a nucleus of z = 72. The distance of closest approach nearly is

(A) 35 fm (B) 45 fm

(C) 25 fm (D) 30 fm

Answer (NA)

Sol. For the distance of closest we know

$$\frac{1}{4\pi\varepsilon_0}\times\frac{Ze\times 2e}{r_0}=K.E$$

$$\Rightarrow \frac{9\times10^9\times72\times(1.6\times10^{-19})^2}{r_0}$$

$$=6\times10^{-3}\times1.6\times10^{-19}$$

$$\Rightarrow r_0=\frac{9\times10^9\times72\times1.6\times10^{-19}}{6\times10^{-3}}$$

$$\Rightarrow r_0=\frac{9\times72\times1.6}{6}\times10^{-7}$$

$\Rightarrow$ r_0 = 17.28 × 10^{-7} m

* No answer is matching

Question ID: 7028632

Arrange the following in increasing order of binding energy per nucleon

A. Li B. Fe

C. O D. N

D. H

Choose the correct answer from the options given below:

(A) E < A < D < C < B (B) A < B < D < E < C

(C) C < B < D < A < E (D) B < D < C < A < E

Answer (A)

Sol. Following is the correct sequence of binding energy per nucleon

H < Li < N < O < Fe

Ans. → E < A < D < C < B

Question ID: 7028633

Arrange the following lines of Balmer series in the increasing order of their wavelength

A. H_δ B. H_β

C. H_∞ D. H_γ

E. $H\alpha$

Choose the correct answer from the options given below:

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

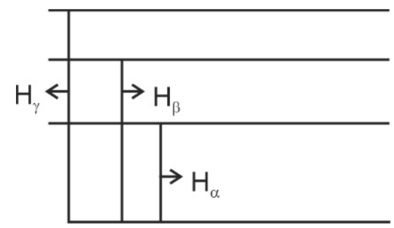
(C) E, B, D, C, A (D) C, A, B, D, E

Answer (A)

Sol. $E\propto\frac{1}{\lambda}$

$\Rightarrow$ $\lambda\propto\frac{1}{E}$

$\Rightarrow$ For minimum energy wavelength would be maximum.



$\Rightarrow$ $H_\alpha > H_\beta > H_y > H_\delta > H_\infty$

$\Rightarrow$ C, A, D, B, E

Question ID: 7028634

For the radioactive material half life is 10 minutes. If initially there are 800 number of nuclei the time taken (in minutes) for the disintegration of 600 nuclei is

(A) 40 minutes (B) 10 minutes

(C) 20 minutes (D) 60 minutes

Answer (C)

Sol. $\Rightarrow$ 600 Nuclei have been disintegrated, hence number of nuclei left = 200

Now, $\left(\frac{N}{N_0}\right)=\left(\frac{1}{2}\right)^n \Rightarrow \left(\frac{200}{800}\right)=\left(\frac{1}{2}\right)^n \Rightarrow n=2$

Time take for disintegration = 2 × 10 = 20 minutes

Question ID: 7028635

The force between a neutron and a proton are

A. Weak

B. Gravitational

C. Nuclear

D. Colombian

E. Electromagnetic

Choose the correct answer from the options given below:

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

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

Answer (D)

Sol. Force between neutron and proton is gravitational and nuclear.

No Coulombian force as neutron is a neutral particle.

Question ID: 7028636

An inductor of inductance 1000 mH is connected in series with a resistance, a variable capacitance and an AC source of frequency 2.0 kHz. What value of the capacitance result in drawing the maximum current from the circuit?

(A) 63 μF (B) 63 nF

(C) 63 mF (D) 63 F

Answer (B)

Sol. At resonance current is maximum

$$\Rightarrow \quad \omega L = \frac{1}{\omega C} \Rightarrow C = \frac{1}{\omega^2 L} \Rightarrow C = \frac{1}{(2\pi f)^2 \times L}$$

$$\Rightarrow \quad C = \frac{1}{\left(2 \times \pi \times 2 \times 10^3\right)^2 \times 100 \times 10^{-3}} = 63 \text{ nF}$$

Question ID: 7028637

Among the following which one is wrong for sky wave propagation?

(A) Aky waves are reflected back to the earth by ionosphere

(B) Sky waves are radio waves of frequency range 2 MHz to 30 MHz

(C) Sky wave propagation is used by short wave broadcast services

(D) Sky waves are radio waves of very high frequency 30 MHz to 300 MHz

Answer (D)

Sol. Sky wave propagation, also known as ionospheric propagation is the mode of propagation in which electromagnetic waves from antenna are reflected back to earth by atmosphere.

The permitted frequency ranges from 3MHz to 30 MHz.

Short wave radio services use sky wave propagation.

It is also used for satellite communication.

Hence the fourth option is wrong.

Question ID: 7028638

A 50m long antenna is mounted on a 200 m tall building. The complex can become transmission tower for waves with wave length

(A) ~ 400 m (B) ~ 200 m

(C) ~ 20 m (D) ~ 4 m

Answer (B)

Sol. According to ques, length of building is = 200 m

And length of antenna is = 50 m

Wavelength of the wave that can be transmitted is as follows:

$\lambda = 4l$

$\Rightarrow \lambda = 4 \times 50 = 200$ m

Question ID: 7028639

The average electric field of electromagnetic waves in certain region of free space is 9×10^{-4} NC^{-1}. Then the average magnetic field in the same region is

(A) 27×10^{-4} T (B) 3×10^{-12} T

(C) $\left(\frac{1}{3}\right) \times 10^{-12}$ T (D) 3×10^{12} T

Answer (B)

Sol. $C = \frac{E_{avg}}{B_{avg}}$

$$\Rightarrow \quad B_{avg} = \frac{9 \times 10^{-4}}{3 \times 10^8} = 3 \times 10^{-12} \text{ T}$$

Question ID: 7028640

Which among the following statement are correct?

A. Ultraviolet rays can be detected with a photocell.

B. X-rays are detected with ionisation chamber

C. Visible light is detected with a thermopile

D. Gamma rays are detected with point contact diodes

E. Infrared rays are detected with a bolometer

Choose the correct answer from the options given below:

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

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

Answer (B)

Sol. Ultraviolet rays are detected with a photocell. X-rays are detected with ionisation chamber. Bolometer is used to detect infrared rays.

Passage:

With your understanding of concept of Inductance, answer the questions.

An electric current can be induced in a coil by flux change produced by another coil in its vicinity or flux change produced by the same coil. The flux through a coil is proportional to the current i.e $\varnothing_\beta \propto I$. If the geometry of the coil does not vary with tune then $\frac{d\varnothing}{dt} \propto \frac{dI}{dt}$. For a closely wound coil of N turns, the same magnetic flux. is linked with all turns: i.e $N\varnothing_\beta \propto I$. The constant of proportionality is called inductance which depends on geometry of coil and dielectric constant of intervining medium. Mutual inductance of a pain of coil solenoids, etc depends on their separation and relative orientation self-inductance of single coil or solenoid depends on geometry of the coil and permeability of the medium. If plays role of inertia.

Question ID: 7028641

An average induced emf of 0.2V appears in coil when the current in it is changed from 5.0A in one direction to 5.0A in the opposite direction in 0.2s. The self-inductance of the coil is

(A) 1 mH (B) 2 mH

(C) 3 mH (D) 4 mH

Answer (D)

Sol. $\varepsilon = -L\frac{di}{dt} \Rightarrow |\varepsilon| = L \times \frac{di}{dt}$

Now, $0.2 = L \times \frac{[5-(-5)]}{0.2} \Rightarrow L = \frac{4}{1000} = 4 \text{ mH}$

Question ID: 7028642

The current in a coil of 1000 turns changes from 1A to 6A, producing a change of flux of 8.5×10^{-4} weber. The self-inductance of the coil is

(A) 1700 mH (B) 170 mH

(C) 1.70 mH (D) 0.170 mH

Answer (B)

Sol. For a coil of 1000 turns, we can write

$N\phi = Li$, where N is number of turns.

$\Rightarrow 1000 \times 8.5 \times 10^{-4} = L \times 5 \Rightarrow L = 1.7 \times 10^{-1}$

$\Rightarrow L = 170 \text{ mH}$

Question ID: 7028643

The current in a coil of self-inductance 100 mH increases from zero to 5 ampere in a given time interval. Find the amount of energy stored during that time

(A) 12.5 J (B) 1.25 J

(C) 0.125 J (D) 125 J

Answer (B)

Sol. Energy stored in inductor carrying current i

$U = \frac{1}{2}Li^2$

$\Rightarrow U = \frac{1}{2} \times 100 \times 10^{-3} \times 25$

$\Rightarrow U = 1.25 \text{ J}$

Question ID: 7028644

Mutual inductance between two perfectly coupled coils is 0.005H. If the instantaneous current in one of the coils is $I = 10\sin 100\pi t$, then the peak value of induced emf in the second coil will be

(A) 10 V (B) 5 V

(C) 10π V (D) 5π V

Answer (D)

Sol. $\Rightarrow \phi = Mi$

$\Rightarrow \varepsilon = -M\frac{di}{dt}, \quad i = 10\sin(100\pi t)$

$\Rightarrow \frac{di}{dt} = 1000\pi\cos(100\pi t)$

$\Rightarrow \varepsilon = -0.005 \times 100 \times \pi\cos(100\pi t)$

$|\varepsilon_{max}| = \frac{5}{1000} \times 1000 \times \pi \times 1$ as max value of $\cos\theta$ is one

$\Rightarrow |\varepsilon_{max}| = 5\pi \text{ V}$

Question ID: 7028645

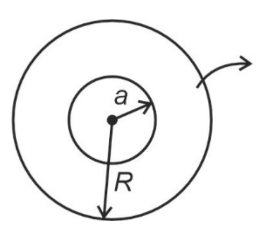
A circular coil of radius r_2 = 6 cm has another concentric coil of radius r_1 = 0.2 cm placed inside it. The arrangement produced mutual inductance M. If the inner coil is replaced with another one having radius r', = 0.3 cm, select the current statement giving the new value of mutual inductance m¢ with respect to the earlier value m.

(A) m' = 0.44 M (B) m' = 1.50 M

(C) m' = 2.25 M (D) m' = 0.67 M

Answer (C)

Sol.



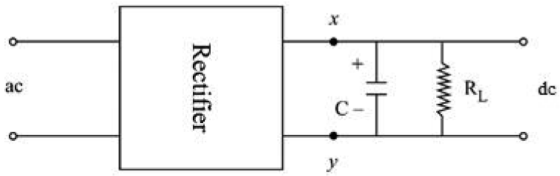
$M = \frac{\mu_0 \pi a^2}{2R}$

$\Rightarrow M \propto a^2$, Now $\frac{M}{m'} = \frac{(0.2)^2}{(0.3)^2} \Rightarrow \frac{M}{m'} = \frac{4}{9}$

$\Rightarrow m' = \frac{9}{4}M = 2.25 \text{ M}$

Passage :

Based on the understanding operations of rectifies answer the questions Diodes can be used for rectifying on ac voltage (restricting the ac voltage to one direction) with the help of a capacitor or a suitable filter, a dc voltage ca be obtained.



Question ID: 7028646

Input and output voltage signal for a device *X* are shown below. Identify *X*.

(A) Zener diode (B) Full wave rectifier

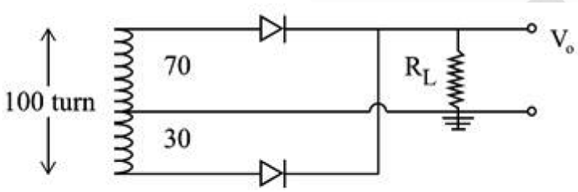
(C) Half wave rectifier (D) Light emitting diode

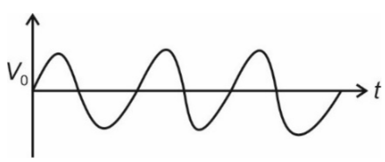
Answer (C)

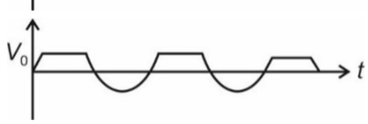
Sol. The output of Half wave rectifier have only one cycle either positive or only negative cycles.

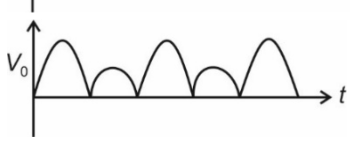
Question ID: 7028647

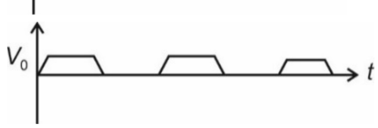
In a full wave rectifier using a 100 secondary turns centre tapped transformer and two diodes, the tapping is erroneously done over turn no. 30 as shown. The output voltage waveform will be as :



(A) 

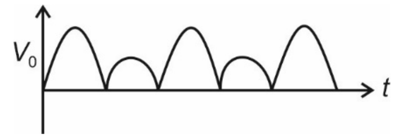
(B) 

(C) 

(D) 

Answer (C)

Sol. As tapping in transformer is not in centre, the ratios of number of turms is 70:30 therefore output have different magnitude (in ratio 70:30) in positive and negative cycles.



Question ID: 7028648

Arrange the device in the process of conversion of alternating current to direct current in proper sequence.

(A) Filter (B) Rectifier

(C) Amplifier (D) Transformer

Choose the correct answer from the options given below :

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

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

Answer (B)

Sol. The block diagram of a dc power supply is

AC input → Transformer → Amplifier → Rectifier → Filter → DC output

Question ID: 7028649

In half wave rectification, if the input frequency is 60 Hz, the output frequency is

(A) 60 Hz (B) 120 Hz

(C) 100 Hz (D) 50 Hz

Answer (A)

Sol. In half wave rectifier $f_{out} = f_{in}$

$\Rightarrow$ f_{out} = 60 Hz

Question ID: 7028650

Capacitor is used in the rectifier circuit because :

(A) It helps to amplify the rectifier output

(B) It helps to convert DC into AC.

(C) It eliminates ripples/Fluctuations and gives almost constant DC voltage output across the

(D) The output voltage obtained by using capacitor as input filler is much higher than the peak voltage of the rectified voltage.

Answer (C)

Sol. In a rectifier capacitor is used as a filter which eliminates ripples and gives almost constant dc output.

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