विद्या सर्वार्थि साधिका

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PRACTICE TEST

Class : XII

Subject: Physics M.M : 70

Date : 23/12/2019 Time : 3 hours

General Instructions:

1. All questions are compulsory. There are 37 questions in all.
2. This question paper has four sections: Section A, Section B, Section C and Section D.
3. Section A contains twenty questions of one mark each, Section B contains seven questions of two marks each, Section C contains seven questions of three marks each, and Section D contains three questions of five marks each.
4. There is no overall choice. However, internal choices have been provided in two questions of one mark each, two questions of two marks, one question of three marks and three questions of five marks weightage. You have to attempt only one of the choices in such questions.
5. You may use the following values of physical constants where ever necessary.

$c = 3 \times 10^8$ m/s
$h = 6.63 \times 10^{-34}$Js
$e = 1.6 \times 10^{-19}$ C
$\mu_0 = 4\pi \times 10^{-7}$ TmA^{-1}
$\varepsilon_0 = 8.85 \times 10^{-12}$ C^{2}N^{-1}m^{-2}
$\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9$ Nm^{2}C^{-2}

me = 9.1×10^{-31} kg
mass of neutron = 1.675×10^{-27} kg
mass of proton = 1.673×10^{-27} kg
Avogadro's number = 6.023×10^{23} per gram mole
Boltzmann constant = 1.38×10^{-23} JK^{-1}

SECTION A

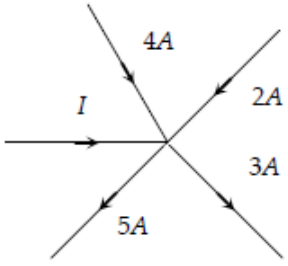
Directions (Q1-Q10) Select the most appropriate option from those given below each question.

1. If a diamagnetic material is placed in a magnetic field, the magnetic field inside the material compared to that outside will be (1)
   (a) Slightly less (b) Slightly more (c) Very high (d) Same

2. Human body radiates (1)
   (a) microwave (b) X-rays (c) infrared rays (d) gamma rays.

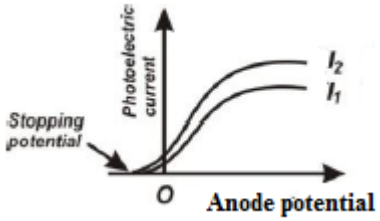
3. What will be the value of electric field at the centre of the electric dipole : (1)
   (a) Zero
   (b) Equal to the electric field due to one charge
   (c) Twice the electric field due to one charge
   (d) half the value of electric field due to one charge

4. In the given current distribution what is the value of I (1)
   (a) 3A (b) 8 A
   (c) 2A (d) 5A



5. The coil of a moving coil galvanometer is wound over a metal frame in order to (1)
(a) reduce hysteresis (b) increase sensitivity
(c) increase moment of inertia (d) provide electromagnetic damping

6. Following graph shows the variation of photoelectric current with anode potential for two light beams of same wavelength but different intensity. Find the correct relation : (1)
(a) $I_1 > I_2$ (b) $I_1 = I_2$
(c) $I_1 < I_2$ (d) $I_1 \leq I_2$

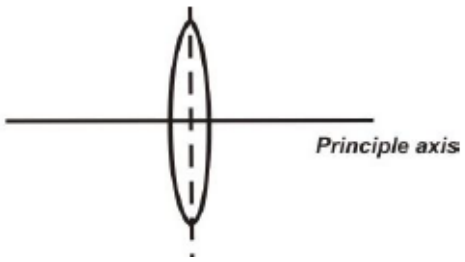


(OR)

An incident ray of energy 2.5 eV ejects an electron from a metal with a kinetic energy of 0.5 eV. The work function of the metals is
(a) 2 J (b) 3.2×10^{-19} J (c) 3 eV (d) 4.8×10^{-19} J

7. In the Uranium radioactive series the initial nucleus is ${}^{238}_{92}U$ and that the final nucleus is ${}^{206}_{82}P$, when uranium nucleus decays to lead, the number of α- particle and β- particle emitted are (1)
(a) $8\alpha, 6\beta$ (b) $6\alpha, 7\beta$ (c) $6\alpha, 8\beta$ (d) $4\alpha, 3\beta$

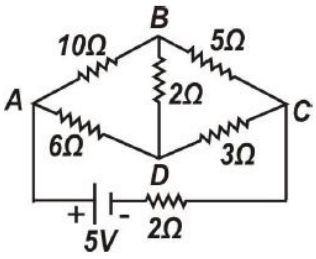
8. An equi-convex lens of focal length 15 cm is cut into two halves as shown in figure (dotted line). Find the focal length of each part? (1)
(a) -30cm (b) -20cm
(c) 30cm (d) -15cm



9. In a Young's double slit experiment, the separation between the slits is 0.1 mm, the wavelength of light used is 600nm and the interference pattern is observed on a screen 1m away. Find the separation between bright fringes. (1)
(a) 6.6 mm (b) 6.0 mm (c) 6 m (d) 60 cm

10. Determine the electric current through branch BD of the electric network: (1)

(a) 0.6 amp (b) 0 amp
(c) 1 amp (d) 10 amp



Directions (Q11 –Q15) Fill in the blanks.

11. A capacitor plates are charged by a battery. After charging battery is disconnected and a dielectric slab is inserted between the plates, the charge on the plates of capacitor _____ . (1)

12. In an ac- circuit, a choke is preferred over resistance to decrease ac- current because it consumes practically _____ power. (1)

13. During reflection or refraction of light, _____ remains unchanged. (1)

14. The maximum kinetic energy of emitted photoelectrons does not depend on the _____ of incident radiation. (1)

15. When a magnetic dipole of moment M rotates freely about its axis from unstable equilibrium to stable equilibrium in a magnetic field B, the rotational kinetic energy gained by it is_____. (1)

(OR)

The current and voltage in the primary coil of a transformer are 2 A and 800 V respectively. The current in secondary coil is 16 A. What is the voltage across secondary coil?

Directions (Q16 – Q20) Answer the following.

16. The initial concentration of a radioactive substance is N_o and its half-life is 12 hours. What will be its concentration after 36 hours? (1)

17. What would the amplitude of the induced emf become if the angular speed of the armature of a dynamo is doubled? (1)

18. Unpolarized light is incident on a plane glass surface having refractive index $\sqrt{3}$. At what angle of incidence at which reflected and refracted rays would become perpendicular to each other? (1)

19. A hollow metal sphere of radius 5 cm is charged such that the potential on its surface is 10 V. What is the potential at the centre of the sphere? (1)

20. An ac source of $200\sqrt{2}\sin(314\,t)$ volt is connected across an incandescent bulb which gives a power dissipation of 50W. When connected across 200V dc, what will be the power dissipation? (1)

SECTION B

21. At what frequency is the current in the LCR series circuit maximum? Explain. (2)
What will be the impedance offered by the LCR series circuit at that frequency?

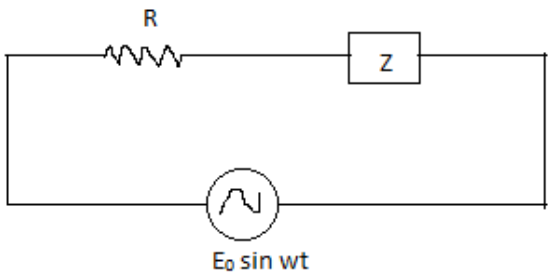
22. Draw the hysteresis curve for ferromagnetic materials. From the graph define coercivity and retentivity. (2)

23. Why microwaves are preferred in RADAR? Give its frequency range. (2)

24. Define self-inductance. When current in a coil changes from 5A to 2A in 0.1 s, an average voltage of 50 V is induced. Determine the self-inductance of the coil. (2)

(OR)

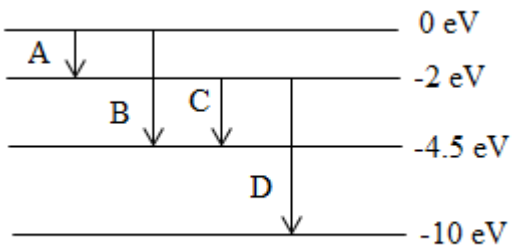
An alternating voltage $E = E_o \sin(\omega t)$ is applied to a circuit containing a resistor R connected in series with a black box z. The current in the circuit is found to be $I = I_o \sin(\omega t + \pi/4)$.



(i) State whether the element in the black box is a capacitor or inductor.

(ii) Draw the corresponding phasor diagram.

25. The energy levels of a hypothetical atom are shown in the figure. Which of the shown transitions will result in the emission of photon of wavelength 275 nm? (2)

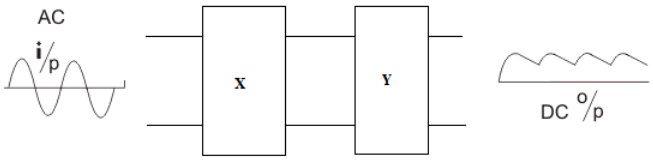


(OR)

Plot a graph showing the variation of binding energy per nucleon as a function of mass number. Which property of nuclear force explains the approximate constancy of binding energy per nucleon in the range $30 < A < 170$?

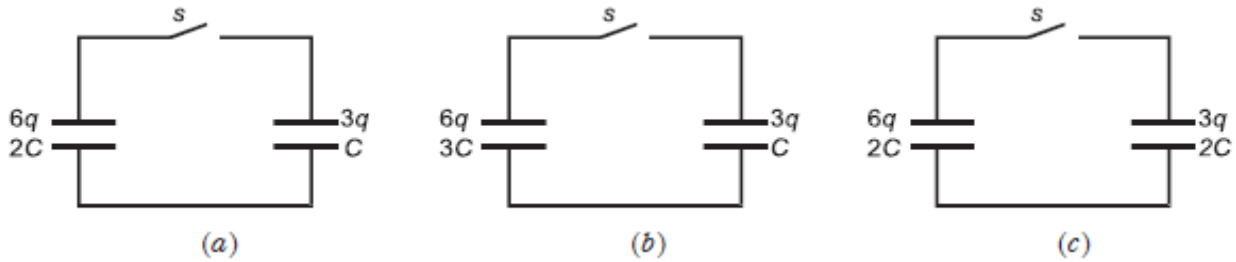
26. From the information of energy band gaps of diodes, how do you decide which can be light emitting diodes? Give any one advantage of LEDs over conventional incandescent low power lamps (2)

27. Identify the circuits shown in the following diagram as X and Y. Also draw the output waveform of X which is fed into Y. (2)



SECTION C

28. Figure shows three circuits, each consisting of a switch and two capacitors initially charged as indicated. After the switch has been closed, in which circuit (if any) will the charges on the left hand capacitor (i) increase, (ii) decrease and (iii) remain same. (3)

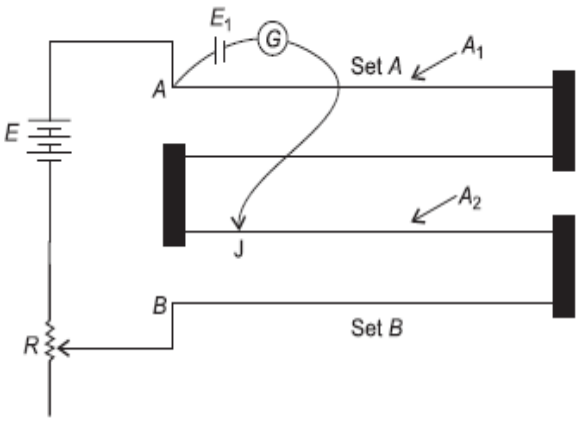


29. You are given two sets of potentiometer circuit to measure the emf E_1 of a cell. (3)
Set A: consists of a potentiometer wire of a material of resistivity ρ_1, area of cross-section A_1 and length l.
Set B: consists of a potentiometer of two composite wires of equal lengths $l/2$ each, of resistivity ρ_1, ρ_2 and area of cross-section A_1, A_2 respectively.

(i)

(ii) Find the relation between resistivity of the two wires with respect to their area of cross-section, if the current flowing in the two sets is same.

(iii) Compare the balancing length obtained in the two sets.



30. (a) Show, with the help of a diagram, how unpolarised sunlight gets polarised due to scattering. (3)
(b) Two polaroids P_1 and P_2 are placed with their pass axes perpendicular to each other. Unpolarised light of intensity I_0 is incident on P_1. A third polaroid P_3 is kept in between P_1 and P_2 such that its pass axis makes an angle of 45° with that of P_1. Determine the intensity of light transmitted through P_1, P_2 and P_3.

31. (a) Write the basic nuclear process involved in the emission of β^+ in a symbolic form, by a radioactive nucleus. (3)
(b) In the reactions given below:
(i) ${}^{11}_{6}C \rightarrow {}^{z}_{y}B + x + \nu$ (ii) ${}^{12}_{6}C + {}^{12}_{6}C \rightarrow {}^{20}_{a}Ne + {}^{c}_{b}He$
Find the values of x, y and z and a, b and c.

32. Draw *V–I* characteristics of a *p–n* junction diode. (3)
Answer the following questions, giving reasons:
(i) Why is the current under the reverse bias almost independent of the applied potential up to a critical voltage?
(ii) Why does the reverse current show a sudden increase at the critical voltage?

33. What is total internal reflection? State two conditions that must be satisfied for total internal reflection to take place. Derive the relation between the critical angle and the refractive index of the medium. (3)

(OR)

Draw ray diagrams to show how a right angled isosceles prism can be used to (i) deviate a ray through 90°, (ii) deviate a ray through 180° and (iii) invert an image without any deviation of the rays.

34. If light of wavelength 412·5 nm is incident on each of the metals given beside, which ones will show photoelectric emission and why? (3)

Metal	Work Function (eV)
Na	1·92
K	2·15
Ca	3·20
Mo	4·17

SECTION D

35. (a) Derive the expression for the magnetic field at a point along the axial line of a current carrying circular coil of N turns and of radius R. (5)
(b) Two concentric circular coils A and B of radii R and 2R having number of turns N and N/2 carry same currents. The current direction in A is clockwise and that in B is anticlockwise. Find the magnetic field at the centre of the coils.

(OR)

(a) Derive the expression for the torque acting on a current carrying loop placed in a magnetic field.
(b) Explain the significance of a radial magnetic field in moving coil galvanometer.
(c) How will you convert a moving coil galvanometer into ammeter?

36. (a) Two equal like charges q coulomb each are placed on the vertices of an equilateral triangle. What charge must be placed on the third vertex so that the total potential energy is zero? (5)

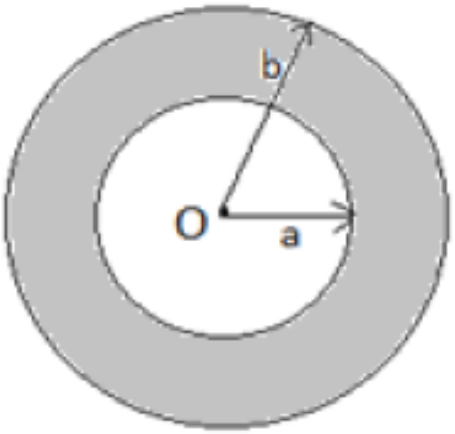
(b) A 200 μF parallel plate capacitor having plate separation of 5 mm is charged by a 100 V dc source. It remains connected to the source. Using an insulated handle, the distance between the plates is doubled and a dielectric slab of thickness 5 mm and dielectric constant 10 is introduced between the plates. Explain with reason, how the (i) capacitance, (ii) electric field between the plates, (iii) energy density of the capacitor will change?

(OR)

(a) A point charge +Q is placed at the centre O of an uncharged hollow spherical conductor of inner radius 'a' and outer radius 'b'. Find the following:

(A) The magnitude and sign of the charge induced on the inner and outer surface of the conducting shell.

(B) The magnitude of electric field vector at a distance (i) r = a, and (ii) r = 2b, from the centre of the shell.



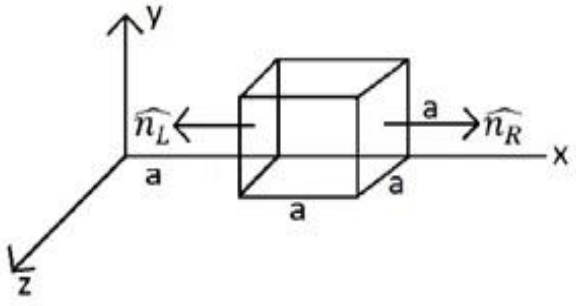
(b) The electric field components in the following figure are

$E_x = \alpha x,\ E_y = 0,\ E_z = 0;$

in which α = 400 N/C m. Calculate:

(i) the electric flux through the cube, and

(ii) the charge within the cube assume that a = 0.1m.



37. (a) Draw a ray diagram for final image formed at distance of distinct vision (D) by a compound microscope and write expression for its magnifying power. (5)

(b) An angular magnification (magnifying power) of 30× is desired for a compound microscope using objective of focal length 1.25cm and eye piece of focal length 5cm. How will you set up the compound microscope?

(OR)

Derive mirror equation for a convex mirror. Using it, show that a convex mirror always produces a virtual image, independent of the location of object.