Roll Number		

SET C

INDIAN SCHOOL MUSCAT
FINAL EXAMINATION
PHYSICS

CLASS: XII | Sub. Code: 042 | Time Allotted: 3 Hrs.

11.11.2019 | Max. Marks: 70

General Instructions:

- All questions are compulsory. There are 37 questions in all.
- This question paper has four sections: Section A, Section B, Section C and Section D.
- 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.
- 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.
- You may use the following values of physical constants where ever necessary.

$h = 6.63 \times 10^{-34}$ Js

$\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1}

$\varepsilon_0 = 8.854 \times 10^{-12}$ $C^2 N^{-1} m^{-2}$

$1eV = 1.6 \times 10^{-19}$J

SECTION – A

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

1 The magnetic force on a charged particle moving in a magnetic field does no work because 1
(a) Kinetic energy of the charged particle does not change
(b) The charge on the particles remains the same
(c) Magnetic force is parallel to the velocity of the particle
(d) Magnetic force is parallel to the magnetic field

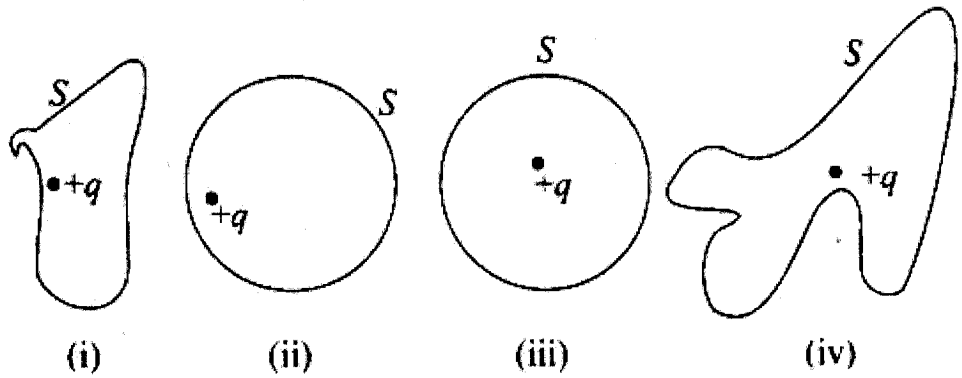
2 Kirchhoff's I law for the electric junction is based on: 1
(a) Law of conservation of charge
(b) Law of conservation of energy
(c) Law of conservation of angular momentum
(d) Law of conservation of mass

3 The colour sequence in a carbon resistor is red, brown, orange and silver. The resistance of the resistor is 1
(a) $21 \times 10^3 \pm 10\%$ (b) $23 \times 10^1 \pm 10\%$ (c) $21 \times 10^3 \pm 5\%$ (d) $12 \times 10^3 \pm 10\%$

4 Neutrons enter a magnetic field B in different directions with the same speed V. Which of the following statements is true? 1

(a) Force is maximum when the angle between B and V is 90^0
(b) Force is maximum when the angle between B and V is 60^0
(c) Force is maximum when the angle between B and V is 0^0
(d) No force acts on the neutrons

5 The electric flux through the surface 1



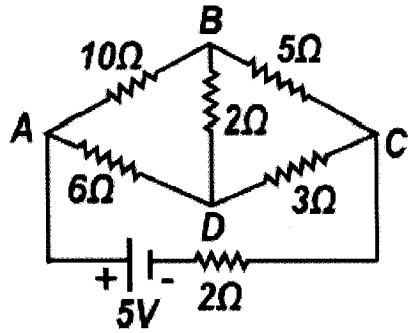
(i) (ii) (iii) (iv)

(a) in Fig.(iv) is the largest
(b) in Fig.(iii) is the largest
(c) in Fig.(ii) is same as Fig.(iii) but is smaller than Fig.(iv)
(d) is the same for all the figures

6 A parallel plate capacitor is charged by a battery. Once it is charged battery is removed. Now a dielectric material is inserted between the plates of the capacitor, which of the following does not change? 1

(a) electric field between the plates (b) potential difference across the plates
(c) charge on the plates (d) energy stored in the capacitor

7 Determine the electric current through branch BD of the electric network: 1



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

8 Nickel shows ferromagnetic property at room temperature. If the temperature is increased beyond Curie temperature, then it will show 1

(a) Paramagnetism (b) Anti-ferromagnetism
(c) No magnetic properties (d) Diamagnetism

9 S.I. unit of magnetic pole strength is 1

(a) Ampere/meter (b) Ampere-meter (c) volt/meter (d) Ampere/meter^2

10 If the no. of turns per unit length of the coil of a solenoid is doubled keeping other dimensions same, then its self-inductance will be 1

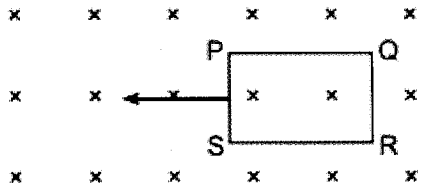
(a) Halved (b) doubled (c) four times (d) eight times

Directions (Q11 –Q15) Fill in the blanks with appropriate answer.

11 The relation for the speed of electromagnetic waves in terms of the amplitudes of electric and magnetic fields is 1

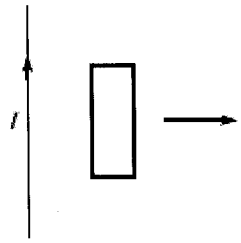
12 Two waves having intensities in the ratio 9:1 produce interference. The ratio of maximum to minimum intensity is..... 1

13 The closed loop (PQRS) of wire is moved into a uniform magnetic field at right angles to the plane of the paper as shown in the figure. The direction of induced current in the loop is 1



OR

A rectangular loop of wire is pulled to the right, away from the long straight wire through which a steady current I flows upwards as shown in the diagram given below. The direction of induced current in the loop is.....



14 An ideal transformer is used on 220V line to deliver 2A at 110V. The current through the primary is 1

15 The electromagnetic radiation which is produced by bombarding a metal target by high speed electrons is 1

Directions (Q16 –Q20) Answer the following:

16 The maximum kinetic energy of a photoelectron is 3eV. What is its stopping potential? 1

OR

Write the expression for the de Broglie wavelength associated with a charged particle having charge 'q' and mass 'm' when it is accelerated by a potential V.

17 Two nuclei have mass numbers in the ratio 2:3. What is the ratio of their nuclear densities? 1

18 The total energy of an electron in the first excited state of the hydrogen atom is about -3.4eV. What is the potential energy of the electron in this state? 1

19 Name the type of wavefront emerging from a point source. 1

20 Name the phenomenon which shows the quantum nature of electromagnetic radiation. 1

SECTION - B

21 Explain with the help of Einstein's photoelectric equation any two observed features in photoelectric effect which cannot be explained by wave theory. 2

OR

(i) Define the terms (a) threshold frequency and (b) stopping potential in photoelectric effect. Draw a schematic diagram of a localized wave describing the wave nature of moving electron.

22 (i) State law of radioactive decay. 2

(ii) Plot a graph showing the number (N) of undecayed nuclei as a function of time (t) for a given radioactive sample having half life $T_{1/2}$.

23 Draw the diagrams to show the behaviour of plane wavefronts as they 2

(i) pass through a thin prism and

(ii) pass through a thin convex lens.

24 (i) A toroidal solenoid with air core has an average radius of 15cm, area of cross section $12cm^2$ and has 1200 turns. Calculate the self inductance of the toroid. Assume the field to be uniform across the cross section of the toroid. 2

(ii) State the law that gives the polarity of the induced emf.

25 Obtain the resonant frequency ω_r of a series LCR circuit with L = 2.0H, C = 32μF and R = 10Ω. 2
What is the quality factor (Q) of this circuit?

26 Explain the term 'drift velocity' of electrons in a conductor. Hence obtain the expression for the current through a conductor in terms of 'drift velocity'. 2

OR

Describe briefly, with the help of a circuit diagram, how a potentiometer is used to determine the internal resistance of a cell.

27 If two similar large plates, each of area A having surface charge densities +σ and – σ are separated by a distance in air, find the expressions for 2

(i) field at points between the two plates and on outer side of the plates. Specify the direction of the field in each case.

(ii) the potential difference between the plates.

SECTION - C

28 What is the effect on the interference fringes in a Young's double slit experiment due to each of the following operations: 3

(i) The screen is moved away from the plane of the slits

(ii) The source slit is moved closer to the double-slit plane

(iii) The monochromatic source is replaced by a source of white light.

29 Draw a graph showing the variation of potential energy between a pair of nucleons as a function of their separation. Indicate the regions in which the nuclear force is (i) attractive, (ii) repulsive. Write two important conclusions which you can draw regarding the nature of the nuclear forces. 3

30 Explain with the help of a labelled diagram the underlying principle and working of an ac generator. 3

OR

(i) An ac voltage $E = E_0 \sin \omega t$ is applied across a pure capacitor of capacitance C. Show mathematically that the current flowing through it leads the applied voltage by a phase angle of $\frac{\pi}{2}$.

(ii) Show graphically the variation of capacitive reactance with frequency of the applied alternating voltage.

31 Write three points of difference between paramagnetic, diamagnetic and ferromagnetic materials giving one example for each. 3

32 Two cells of emfs E_1 and E_2 and internal resistances r_1 and r_2 are connected in parallel. Derive the expression for the (i) emf and (ii) internal resistance of a single equivalent cell which can replace this combination. 3

33 Define an equipotential surface. Draw equipotential surfaces: 3

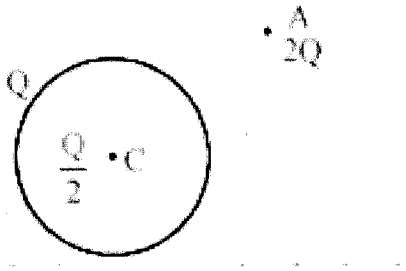
(i) in the case of a single point charge

(ii) in a constant electric field in the z-direction.

Why the equipotential surfaces about a single charge are not equidistant?

34 3

A thin metallic spherical shell of radius R carries a charge Q on its surface. A point charge Q/2 is placed at its centre C and another charge + 2Q is placed outside the shell at A at a distance x from the centre.



(i) Find the force on the charge at the centre C of the shell and at the point A

(ii) Find the electric flux through the shell.

(iii)State the law used.

SECTION - D

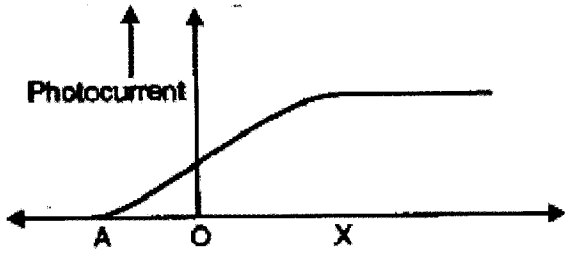
35 (i) Define the distance of closest approach. An α-particle of kinetic energy 'K' is bombarded on a thin gold foil. The distance of the closest approach is 'r'. What will be the distance of closest approach for an α-particle of double the kinetic energy? 5

(ii) Write two important limitations of Rutherford's nuclear model of the atom.

(iii)The electron in hydrogen atom is initially in the third excited state. What is the maximum number of spectral lines which can be emitted when it finally moves to the ground state? What are the possible transitions that can occur in this case?

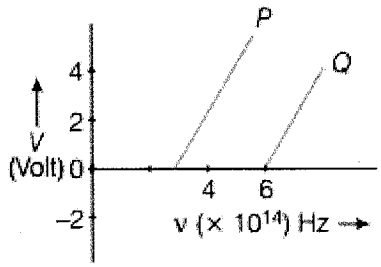
OR

(a) The following graph shows the variation of photocurrent for a photosensitive metal:



(i) Identify the variable X on the horizontal axis.
(ii) What does the point A on the horizontal axis represent?
(iii) Draw this graph for three different values of frequencies of incident radiation υ_1, υ_2 and υ_3 $(\upsilon_1 \rangle \upsilon_2 \rangle \upsilon_3)$ for same intensity.
(iv) Draw this graph for three different values of intensities of incident radiation I_1, I_2 and I_3 $(I_1 \rangle I_2 \rangle I_3)$ having same frequency.

(b) In the study of a photoelectric effect the graph between the stopping potential 'V' and frequency 'ν' of the incident radiation on two different metals P and Q is shown below:



(i) Determine the work function of the metal which has greater value.
(ii) Find the maximum kinetic energy of electron emitted by light of frequency 8×10^{14}Hz for this metal.

36 (i) Use Biot-Savart law to derive the expression for the magnetic field on the axis of a current carrying circular loop of radius R. 5
(ii) Draw the magnetic field lines due to a circular wire carrying current I.
(iii) Write any two important points of similarities and differences each between Coulomb's law for the electrostatic field and Biot-Savart's law for the magnetic field.

OR

(i) Two long straight parallel conductors carrying steady current I_1 and I_2 are separated by a distance'd'. If the currents are flowing in the same direction, explain briefly with the help of a suitable diagram how the magnetic field set up in one produce a force on the other. Obtain an expression for this force. What is the nature of this force?
(ii) Why is it necessary to use (a) a radial magnetic field and (ii) a cylindrical soft iron core in a galvanometer?
(iii) Can a galvanometer as such be used for measuring the current? Explain.

37 (i) State law of Malus. 5
(ii) Draw a graph showing the variation of intensity (I) of polarized light transmitted by an

analyser with angle (θ) between polarizer and analyser.

(iii) What is the value of refractive index of a medium of polarizing angle 60^0?

(iv) Explain with the help of a diagram how linearly polarized light can be obtained by the process of scattering of light?

OR

(i) A monochromatic source of light of wavelength λ illuminates a narrow slit of width 'd' to produce a diffraction pattern on the screen. Obtain the conditions when secondary wavelets originating from the slit interfere to produce maxima and minima on the screen.

(ii) How would the diffraction pattern be affected when

(a) the width of the slit is decreased?

(b) the monochromatic source of light is replaced by white light?

End of the Question Paper