Roll Number		

SET C

INDIAN SCHOOL MUSCAT
SECOND PRE-BOARD EXAMINATION
PHYSICS

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

06.04.2021 | Max. Marks: 70

General Instructions:

1. **All questions are compulsory. There are 33 questions in all.**
2. **This question paper has five sections: Section A, Section B, Section C, Section D and section E.**
3. **Section A contains ten very short answer questions and four assertion reasoning MCQs of 1 mark each, Section B has two case based questions of 4 marks each, Section C contains nine short answer questions of 2 marks each, Section D contains five short answer questions of 3 marks each and Section E contains three long answer questions of 5 marks each.**
4. **There is no overall choice. However, an internal choice is provided. You have to attempt only one of choices in such questions.**
5. **You may use the following values of physical constants wherever necessary.**

$c = 3 \times 10^8$ m/s , $h = 6.63 \times 10^{-34}$ Js , $e = 1.6 \times 10^{-19}$ C , $\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1}

$\varepsilon_0 = 8.854 \times 10^{-12}$ C^2 N^{-1} m^{-2} , $1/4\pi\varepsilon_0 = 9 \times 10^9$ N m^2 C^{-2} , $m_e = 9.1 \times 10^{-31}$ 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

All questions are compulsory. In case of internal choices, attempt any one of them.

1 Give the ratio of number of holes and number of conduction electrons in in an intrinsic semiconductor. 1

2 Name the physical quantity having the S.I. unit Am. 1

1

3 How does the width of depletion region change in p-n junction diode in (a) forward bias (b) reverse bias ?

4 A semiconductor has equal electron and hole concentration of $6 \times 10^4 \ m^{-3}$ .On doping with certain impurity, electron concentration increases to $8 \times 10^{12} \ m^{-3}$.Identify the type of semiconductor obtained after doping. 1

OR

Name the type of semiconductor formed when pure semiconductor, Germanium (Ge) is doped with Boron.

5 Name the electromagnetic radiations used for studying the crystal structure of solids 1

OR

Write the expression for velocity of electromagnetic waves in terms of permittivity and permeability of the medium.

6. What is the ratio of nuclear densities of the two nuclei having mass numbers in the ratio 1 :4 ? 1

7. How does the self-inductance of an air core coil change, when i) the number of turns in the coil is decreased? ii) an iron rod is introduced in the coil? 1

OR

The emf of an ac source is given by the expression, E= 300 sin 314 t. Write the peak voltage .

8. Name the material which is used to make control rods in nuclear reactors. 1

OR

Two nuclei have mass numbers in the ratio 1:8.What is the ratio of nuclear radii?

9. A moving charged particle enters a magnetic field with a velocity v, at an angle 30^0 to the direction of magnetic field. What will be the trajectory of the particle in the magnetic field 1

10. Two metals A and B have work functions 2eV and 4 eV respectively. Which metal has a lower threshold frequency for photo electric effect? Explain. 1

For question numbers 11, 12, 13 and 14 two statements are given- one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true and R is not the correct explanation of A

(c) A is true but R is false

(d) **A is false but R is also false**

11 Assertion(A):

A convex lens may be diverging.

Reason (R):

The nature of lens depends upon the refractive index of the lens and that of the surrounding medium.

12 Assertion (A):

When an electric dipole is placed in a non-uniform electric field, a torque acts but no net force acts on the dipole.

Reason (R) :

A net force would act on dipole if it is placed in a uniform electric field.

13. Assertion(A) :

Different colours of light travel with different speeds in vacuum.

Reason(R) :

Wavelength of light does not depend on the refractive index of medium.

14. Assertion (A):

Work done in moving a charge between any two points in an electric field is independent of the path followed by the charge, between these points.

Reason (R):

Electrostatic force is a conservative force.

SECTION - B

Questions 15 and 16 are Case Study based questions and are compulsory. Attempt any 4 sub parts from each question. Each question carries 1 mark.

15. Coulomb's law is a quantitative statement about the force between two point charges. When the linear sizes of charged bodies are much smaller than the distance between them, their sizes may be ignored and the charged bodies are called point charges. In 1776, Coulomb, a French physicist discovered a torsion balance to measure a small quantity of force and used it for determination of forces of attraction or repulsion between small charged spheres. He thus arrived in 1785 at the inverse square law relation, now known as Coulomb's Law. He found that the force between two point charges varied inversely with the square of the distance and was directly proportional to the product of the magnitude of the charges and is directed along the line joining the two charges. Coulomb's law is an electrical analogue of Newton's law of Gravitation in mechanics.

1. Which of the following statement is wrong about electrostatic force

   (a) Force varies inversely with the square of distance between the charges.

   (b) Force varies directly with the product of magnitude of the charges.

   (c) Force does not depend on the intervening medium

   (d) Force is conservative in nature

2. The electrostatic force between two point charges is F. If each of the two point charges are doubled and the distance between them is halved the force of interaction becomes n times , where n is

   (a) 4 (b) 1 (c) 18 (d) 16

3. A charge q_1 exerts some force on a second charge q_2.If a third charge q_3 is brought near ,the force on q_2 exerted by q_1

   (a) Decreases

   (b) Increases

   (c) Remains same

   (d) increases if q_3 is of the same sign and decreases if q_3 is of opposite sign.

4. Two charges 3×10^{-5} C and 5×10^{4} C are placed at a distance of 10 cm from each other in vacuum. The value of electrostatic force acting between them is

   (a) 13.5×10^{11} N

   (b) 40×10^{11} N

   (c) 180×10^{9} N

   (d) 13.5×10^{10} N

5. When air is replaced by a dielectric medium of constant 4, the maximum force of attraction between two charges separated by a certain distance

   (a) Decreases 4 times

   (b) Remains unchanged

   (c) Increases 4 times

   (d) First increases, then decreases

16. An important characteristic of light waves is to interfere with one another. In daily life interference is demonstrated by the light reflected from a film of oil floating on water. Another example is the soap bubble reflecting a variety of beautiful colours when illuminated by natural or artificial light source. These beautiful colours are produced due to interference between the light reflected from the inner surface of bubble and the outer surface both constructively and destructively. The bright colours are seen in soap bubble due to constructive interference.

1. Sustained interference pattern can be produced by

   (a) a single light source

   (b) two coherent sources of light

   (c) two independent light sources

   (d)none of the above

2. The colours in thin film of oil floating on water surface is due to

   (a) Interference

   (b) Diffraction

   (c) Polarization

   (d) scattering

3. In interference of light ,the intensity of all maxima are

   (a) different

   (b) same

   (c) depends on the wavelength of light

   (d) none of the above

4. Interference of light shows

   (a) wave nature of light

   (b) particle nature of light

   (c) dual nature of light

   (d) straight line path of light

5. For constructive interference the path difference between light waves interfering will be

   (a) integral multiple of $\lambda/2$

   (b) odd integral multiple of $\lambda/2$

   (c) even integral multiple of $\lambda/2$

   (d) integral multiples of λ

SECTION - C

All questions are compulsory. In case of internal choices, attempt anyone.

17. (a) Explain why photodiodes are used in reverse bias. 2

    (b) Distinguish between n- type semiconductor and p- type semiconductor (two points).

18. Derive Snell's law on the basis of Huygens' wave theory when light is travelling from a denser to a rarer medium. 2

OR

Depict the shape of a wavefront in each of the following cases.

(a) Light diverging from point source.

(b) Light emerging out of a convex lens when a point source is placed at its focus.

19. (a) Why is it necessary to introduce a cylindrical soft iron core inside the coil of a galvanometer? 2

(b) Increasing the current sensitivity of a galvanometer may not necessarily increase its voltage sensitivity. Explain.

20. What is effect on the interference fringes in a Young's double slit experiment due to each of the following operations : 2

(a) the screen is moved away from the plane of the slits,

(b) the source slit is moved closer to the double slit plane.

21. Show that the current leads the voltage in phase by $\pi/2$ in an ac circuit containing an ideal capacitor. 2

22. Three capacitors of capacitances 2pF, 3pF and 4pF are connected in parallel. 2

(a) What is the total capacitance of the combination?

(b) Determine the charge on each capacitor if the combination is connected to 100 V supply.

OR

(a) Draw the equipotential surfaces corresponding to a uniform electric field in the z direction.

(b) Can electric potential at a point be zero while the electric field is not zero? If so give an example.

23. Draw the circuit diagram showing p-n junction diode as full wave rectifier. Show input and output wave forms for the full wave rectifier. 2

24. (a) Name the three elements of the Earth's magnetic field. 2

(b) Where on the surface of Earth is the horizontal component of the Earth's magnetic field is zero?

OR

Define the term, angle of dip. Where on the earth's surface is the value of angle of dip

(a) maximum (b) minimum.

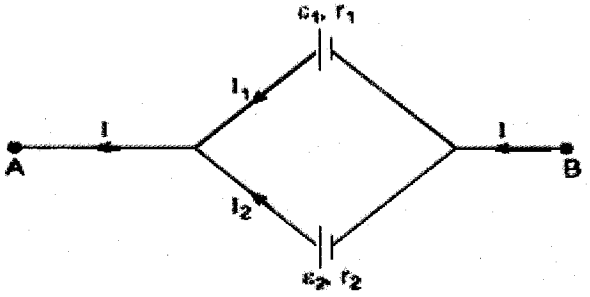
25. In Young's double slit experiment, two slits are 1mm apart and the screen is placed 1 m away from the slits. Calculate the fringe width when light of wavelength 500 nm is used. 2

SECTION - D

All questions are compulsory. In case of internal choices, attempt anyone.

26. Define self-inductance of a coil. Obtain the expression for the energy stored in an inductor L connected across a source of emf. 3

27. Two cells of emfs ε_1, ε_2 and internal resistance r_1 and r_2 respectively are connected in parallel as shown in the figure. Deduce the expressions for 3



the equivalent emf of the combination, (b) the equivalent resistance of the combination

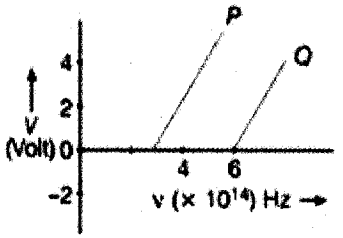
OR

(a) Why alloys like constantan and manganin are used for making standard resistors?

(b) Why are connections between resistors in a meter bridge made of thick copper strips?

(c) Why is it generally preferred to obtain the balance point near the middle of the bridge wire in meter bridge experiments?

28. In the study of a photoelectric effect the graph between the stopping potential V and frequency υ of the incident radiation on two different metals P and Q is shown below: 3



(a) Which one of the two metals has higher threshold frequency?

(b)Calculate the work function for the metal which has greater value.

(c) If the intensity of incident radiation is increased what change can be observed in the stopping potential?

29. Plot a graph showing the variation of potential energy of a pair of nucleons as a function of their separation. Indicate the regions in which the nuclear force is (a) attractive (b) repulsive. 3

30. Determine the distance of closest approach when an alpha particle of kinetic energy 4.5 MeV strikes a nucleus of Z= 80, stops and reverses its direction. 3

SECTION - E

All questions are compulsory. In case of internal choices, attempt anyone.

31. (a) Write Faraday's law of electromagnetic induction. Express it mathematically. 5

(b) A conducting rod of length *l* with one end pivoted ,is rotated with a uniform angular speed ω in a vertical plane, normal to a uniform magnetic field B. Deduce an expression for the emf induced in the rod. (c) If resistance of the rod is R, what is the current induced in it.

OR

(a)Describe briefly the working of a step up transformer, with a help of a diagram.

(b) Deduce the expression for the secondary to primary voltage in terms of the number of turns in the two coil.

(c) Write any two sources of energy loss in a transformer.

32 (a) State Gauss's law in electrostatics. 5

(b) Using Gauss's law obtain the expression for electric field due to an infinitely long straight thin charged wire with uniform linear charge density λ C/m.

(c) Draw variation of the electric field with perpendicular distance from the charged wire.

OR

(a) Define electric dipole moment of an electric dipole. Write its SI unit.

(b) An electric dipole is kept in a uniform electric field E. Diagrammatically represent the position of dipole in stable and unstable equilibrium and write the expression for the torque acting on the dipole and potential energy of dipole in both the cases.

33. (a) What are coherent sources of light? Write two conditions for sustained interference pattern. 5

(b) Derive a mathematical expression for the width of interference fringes obtained in Young's double slit experiment with the help of a suitable diagram.

OR

A thin convex lens having two surfaces of radii of curvature R_1 and R_2 is made of a material of refractive index n_2. It is kept in a medium of refractive index n_1. Derive, with the help of a ray diagram, the lens maker formula when a point object placed on the principal axis in front of the radius of curvature R_1 produces an image I on the other side of the lens.

End of the Question Paper