Roll Number **SET A**

INDIAN SCHOOL MUSCAT
FIRST PRE-BOARD EXAMINATION
PHYSICS

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

18.01.2020 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, an internal choice has 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 choices in such questions.
- 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 $= 1.675 \times 10^{-27}$ **kg**

mass of proton $= 1.673 \times 10^{-27}$ **kg**

Avogadro's number $= 6.023 \times 10^{23}$ **per gram mole**

Boltzmann constant $= 1.38 \times 10^{-23}$ JK^{-1}

SECTION - A

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

1. A **2** μF capacitor is charged to **200** volt and then the battery is disconnected. When it is connected in parallel to another uncharged capacitor, the potential difference between the plates of both is **40** volt. The capacitance of the other capacitor is 1

(a) 2 μF (b) 4 μF (c) 8 μF (d) 16 μF

2. A method for charging a conductor without bringing a charged object in contact with it is called 1

(a) electrification (b) magnetization (c) electromagnetic induction (d) electrostatic induction

3. Two bulbs each marked **100** W, **220** V are connected in series across **220** V supply. The power consumed by them, when lit, is 1

(a) 220 W (b) 100 W (c) 50 W (d) zero

4. Two cells of emf's approximately **5**V and **10** V are to be accurately compared using a potentiometer of length **400**cm. 1

(a) The battery that runs the potentiometer should have voltage of 8V.

(b) The battery of potentiometer can have a voltage of 15 V and R adjusted so that the potential drop across the wire slightly exceeds 10 V.

(c) The first portion of 50 cm of wire itself should have a potential drop of 10 V.

(d) Potentiometer is usually used for comparing resistances and not voltages.

5. In a permanent magnet at room temperature 1

(a) magnetic moment of each molecule is zero.

(b) the individual molecules have non-zero magnetic moment which are all perfectly aligned.

(c) domains are partially aligned.

(d) domains are all perfectly aligned.

6. The self inductance **L** of a solenoid of length ***l*** and area of cross-section **A**, with a fixed number of turns **N** increases as 1

(a) *l* and A increases (b) *l* decreases and A increases

(c) *l* increases and A decreases (d) both *l* and A decreases

7. In an a.c. circuit, the maximum value of voltage is **423** volts. Its effective voltage is 1

(a) 400 V (b) 300 V (c) 323 V (d) 340 V

8. If **E** and **B** represent electric and magnetic field vectors of electromagnetic wave, the direction of propagation of electromagnetic wave is along 1

(a) **E** (b) **B** (c) **B** x **E** (d) **E** x **B**

9. For light diverging from a point source 1

(a) the wavefront is spherical (b) the wavefront is plane

(c) the wavefront is cylindrical (d) the wavefront is parabolic

10. For a given kinetic energy, which of the following has smallest de- Broglie wavelength: 1

(a) electron (b) proton (c) deuteron (d) α – particle

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

11. At Curie point of ferromagnetic material becomes _____. 1

12. Nature of magnetic field in a moving coil galvanometer is _____. 1

13. Angle made by the earth's total magnetic field with horizontal direction is known as _____. 1

14. Virtual image formed by convex mirror has magnification_____. 1

OR

Blue colour of sky is due to phenomena of _____ of light.

15. The S.I. unit of 'activity 'of radioactive substance is _____. 1

Directions (Q16-Q20) Answer the following:

16. Why is it found experimentally difficult to detect neutrinos in nuclear β – decay? 1

17. How are eddy currents reduced in a metallic conductor? 1

18. What happens to the width of depletion layer of ap-n junction when it is forward biased? 1

OR

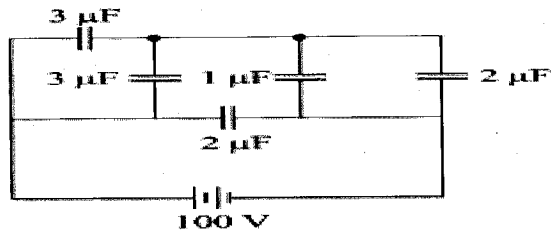
Define the term 'barrier potential'.

19. State Ampere's circuital Law. 1

20. When an a.c. source is connected to an ideal inductor show that the average power supplied by the source over a complete cycle is zero. 1

SECTION - B

21. The figure shows a network of five capacitors connected to a **100** V supply. Calculate the total energy stored in the network. 2



22. State the underlying principle of a potentiometer. Write two factors by which current sensitivity of a potentiometer can be increased. 2

23. An **α**- particle and a proton of the same kinetic energy are in turn allowed to pass through a magnetic field **B**, acting normal to the direction of motion of the particles. Calculate the ratio of radii of circular paths described by them. 2

OR

The susceptibility of a magnetic material is **0.9853**. Identify the type of magnetic material. Draw the modification of the field pattern on keeping a piece of this material in a uniform magnetic field.

24. (a) Write the necessary conditions for the phenomena of total internal reflection to occur. 2

(b) Write the relation between the refractive index and critical angle for given pair of optical media.

25. State Brewster's law. The value of Brewster angle for a transparent medium is different for light of different colours. Give reason. 2

26. (a) What characteristic property of nuclear force explains the constancy of binding energy per nucleon (BE/A) in the range of mass number '**A**' lying **30 < A < 170**? 2

(b) Show that the density of nucleus over wide range of nuclei is constant independent of mass number **A**.

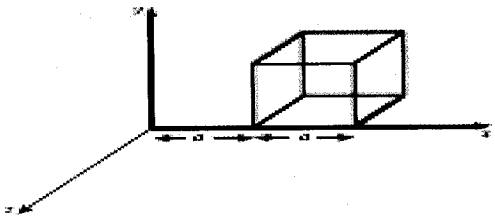
OR

Calculate the shortest wavelength of light emitted in Paschen series of hydrogen spectrum. Which part of the electromagnetic spectrum, does it belong? (Rydberg constant, $\mathbf{R = 1.1 \times 10^7\ m^{-1}}$)

27. Draw energy band diagrams of a **n**-type and a **p**-type semiconductor at temperature **T > 0K**. Mark the donor and acceptor energy levels with their energies. 2

SECTION - C

28. State Gauss's law in electrostatic. A cube with each side '**a**' is kept in an electric field given by $\vec{E} = \mathbf{C} \times \hat{\imath}$, (as is shown in the figure) where **C** is a positive dimensional constant. Find out (i) the electric flux through the cube, and (ii) the net charge inside the cube. 3



29. Draw a labeled diagram of a moving coil galvanometer. Describe briefly its principle and working. Why is it necessary to introduce a cylindrical soft iron core inside the coil of a galvanometer? 3

30. A source of AC voltage $V = V_0 \sin\omega t$ is connected to a series combination of resistor '**R**' and a capacitor '**C**'. Draw the phasor diagram and use it to obtain the expression for (a) impedance of the circuit and (b) phase angle. 3

OR

Explain the meaning of the term mutual inductance. Consider two concentric circular coils, one of radius $\mathbf{r_1}$ and other of radius $\mathbf{r_2}$ ($\mathbf{r_1 > r_2}$) placed coaxially with centers coinciding with each other. Obtain the expression for the mutual inductance of the arrangement.

31. (a) Name the electromagnetic radiation used to take the photograph of the bones. 3

(b) How is this radiation produced?

(c) Mention the range of the wavelength of this electromagnetic radiation.

32. A compound microscope has an objective lens of focal length **1.25** cm and eyepiece of focal length **5** cm. A small object is kept at **2.5** cm from the objective lens. If final image is formed at infinity, find the distance between the objective lens and the eyepiece. 3

33. (a) Describe, with the help of a circuit diagram, the working of Zener diode as a voltage regulator. 3

(b) Give two advantages of using LEDs over conventional incandescent lamps.

34. 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. 3

Write two important conclusions which you can draw regarding the nature of the nuclear forces.

SECTION – D

35. (a) Derive an expression for the electric **E** due to a dipole of length **'2a'** at a point distant **r** from the centre of the dipole on the axial line. 5

(b) Draw a graph of **E** versus **r** for **r >> a**.

(c) If this dipole were kept in a uniform external electric field $\mathbf{E_0}$, diagrammatically represent the position of the dipole in stable and unstable equilibrium and write the expressions for the torque acting on the dipole in both the cases.

OR

(a) Define the drift velocity and relaxation time.

(b) On the basis of electron drift, derive an expression for resistivity in terms of number density of free electrons and relaxation time.

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

36. (a) Draw a ray diagram to show refraction of ray of monochromatic light passing through a glass prism. Deduce the expression for the refractive index of glass in terms of angle of prism and angle of minimum deviation. 5

(b) Draw a ray diagram showing the formation of image by a reflecting type telescope.

OR

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

(b) Describe any two characteristic features which distinguish between interference and diffraction phenomena.

37. (a) Using photon picture of light, show how Einstein's photoelectric equation can be established. 5

Write two features of photoelectric effect which cannot be explained by wave theory.

(b) A proton and **α-** particle have the same de-Broglie wavelength. Determine the ratio of their accelerating potentials.

OR

Using Bohr's postulates, obtain the expression for the total energy of the electron in the stationary states of the hydrogen atom. Hence draw the energy level diagram showing how the line spectra corresponding to Balmer series occur due to transition between energy levels.

End of the Question Paper

Roll Number **SET B**

INDIAN SCHOOL MUSCAT
FIRST PRE-BOARD EXAMINATION
PHYSICS

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$\varepsilon_0 = 8.854 \times 10^{-12}$ 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

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

1. In a permanent magnet at room temperature 1

(a) magnetic moment of each molecule is zero.

(b) the individual molecules have non-zero magnetic moment which are all perfectly aligned.

(c) domains are partially aligned.

(d) domains are all perfectly aligned.

2. Two cells of emf's approximately **5**V and **10** V are to be accurately compared using a potentiometer of length **400**cm. 1

(a) The battery that runs the potentiometer should have voltage of 8V.

(b) The battery of potentiometer can have a voltage of 15 V and R adjusted so that the potential drop across the wire slightly exceeds 10 V.

(c) The first portion of 50 cm of wire itself should have a potential drop of 10 V.

(d) Potentiometer is usually used for comparing resistances and not voltages.

3. Two bulbs each marked **100** W, **220** V are connected in series across **220** V supply. The power consumed by them, when lit, is 1

(a) 220 W (b) 100 W (c) 50 W (d) zero

4. A method for charging a conductor without bringing a charged object in contact with it is called 1

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5. A **2** μF capacitor is charged to **200** volt and then the battery is disconnected. When it is connected in parallel to another uncharged capacitor, the potential difference between the plates of both is **40** volt. The capacitance of the other capacitor is 1

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(a) **E** (b) **B** (c) **B** x **E** (d) **E** x **B**

9. In an a.c. circuit, the maximum value of voltage is **423** volts. Its effective voltage is 1

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10. The self inductance **L** of a solenoid of length ***l*** and area of cross-section **A**, with a fixed number of turns **N** increases as 1

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11. The S.I. unit of 'activity 'of radioactive substance is _____. 1

12. At Curie point of ferromagnetic material becomes _____. 1

13. Nature of magnetic field in a moving coil galvanometer is _____. 1

14. Angle made by the earth's total magnetic field with horizontal direction is known as _____. 1

15. Virtual image formed by convex mirror has magnification_____. 1

OR

Blue colour of sky is due to phenomena of _____ of light.

Directions (Q16-Q20) Answer the following.

16. How are eddy currents reduced in a metallic conductor? 1

17. Why is it found experimentally difficult to detect neutrinos in nuclear β – decay? 1

18. When an a.c. source is connected to an ideal inductor show that the average power supplied by the source over a complete cycle is zero. 1

19. State Biot – Savart Law. 1

20. What happens to the width of depletion layer of a p-n junction when it is reversed biased? 1

OR

State the reason, why GaAs is most commonly used in making of a solar cell.

SECTION - B

21. State Brewster's law. The value of Brewster angle for a transparent medium is different for light of different colours. Give reason. 2

22. (a) What characteristic property of nuclear force explains the constancy of binding energy per nucleon (BE/A) in the range of mass number '**A**' lying **30 < A < 170**? 2

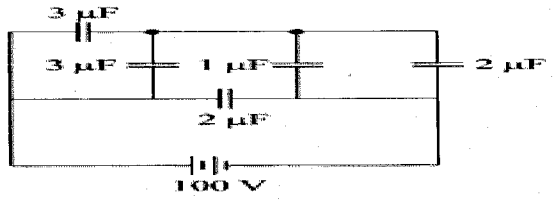
(b) Show that the density of nucleus over wide range of nuclei is constant independent of mass number **A**.

OR

Calculate the shortest wavelength of light emitted in Paschen series of hydrogen spectrum. Which part of the electromagnetic spectrum, does it belong? (Rydberg constant, $\mathbf{R = 1.1 \times 10^7\ m^{-1}}$)

23. Write two points of difference between intrinsic and extrinsic semiconductors. 2

24. The figure shows a network of five capacitors connected to a **100** V supply. Calculate the total energy stored in the network. 2



25. Use Kirchhoff's rules to obtain balance conditions in a Wheatstone bridge. 2

26. An **α-** particle and a proton of the same kinetic energy are in turn allowed to pass through a magnetic field **B**, acting normal to the direction of motion of the particles. Calculate the ratio of radii of circular paths described by them. 2

OR

The susceptibility of a magnetic material is **0.9853**. Identify the type of magnetic material. Draw the modification of the field pattern on keeping a piece of this material in a uniform magnetic field.

27. (a) State the principle on which the working of an optical fibre is based. 2

(b) What are the necessary conditions for this phenomenon to occur?

SECTION - C

28. Draw a labeled diagram of a moving coil galvanometer. Describe briefly its principle and working. Why is it necessary to introduce a cylindrical soft iron core inside the coil of a galvanometer? 3

29. A compound microscope has an objective lens of focal length **1.25** cm and eyepiece of focal length **5** cm. A small object is kept at **2.5** cm from the objective lens. If final image is formed at infinity, find the distance between the objective lens and the eyepiece. 3

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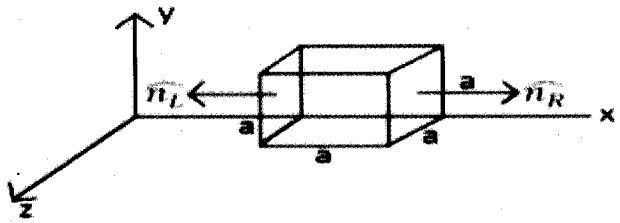
31. Draw a graph showing the variation of potential energy between a pair of nucleons as a function of their separation. Indicate the regions in which the nuclear force is (i) attractive, (ii) repulsive. Write two important conclusions which you can draw regarding the nature of the nuclear forces. 3

32. The electric field components in the following figure are Ex = αx, Ey = 0, Ez= 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. 3



33. A source of AC voltage $V = V_0 \sin\omega t$ is connected to a series combination of resistor '**R**' and a capacitor '**C**'. Draw the phasor diagram and use it to obtain the expression for (a) impedance of the circuit and (b) phase angle. 3

OR

Explain the meaning of the term mutual inductance. Consider two concentric circular coils, one of radius r_1 and other of radius r_2 ($r_1 > r_2$) placed coaxially with centers coinciding with each other. Obtain the expression for the mutual inductance of the arrangement.

34. Name the parts of the electromagnetic spectrum which is 3

(a) suitable for radar systems used in aircraft navigation.

(b) used to treat muscular strain

(c).used as a diagnostic tool in medicine.

Write in brief, how these waves can be produced.

SECTION - D

35. (a) Draw a ray diagram to show refraction of ray of monochromatic light passing through a glass prism. Deduce the expression for the refractive index of glass in terms of angle of prism and angle of minimum deviation. 5

(b) Draw a ray diagram showing the formation of image by a reflecting type telescope.

OR

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OR

Using Bohr's postulates, obtain the expression for the total energy of the electron in the stationary states of the hydrogen atom. Hence draw the energy level diagram showing how the line spectra corresponding to Balmer series occur due to transition between energy levels.

37. (a) Derive an expression for the electric **E** due to a dipole of length **'2a'** at a point distant **r** from the centre of the dipole on the axial line. 5

(b) Draw a graph of **E** versus **r** for **r >> a**.

(c) If this dipole were kept in a uniform external electric field $\mathbf{E_0}$, diagrammatically represent the position of the dipole in stable and unstable equilibrium and write the expressions for the torque acting on the dipole in both the cases.

OR

(a) Define the drift velocity and relaxation time.

(b) On the basis of electron drift, derive an expression for resistivity in terms of number density of free electrons and relaxation time.

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

End of the Question Paper

Roll Number **SET C**

INDIAN SCHOOL MUSCAT
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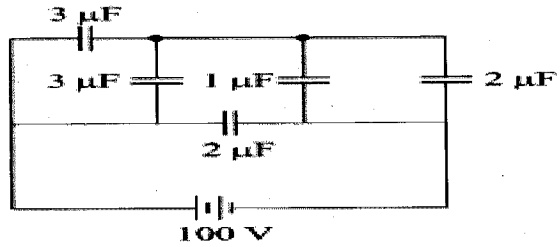

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OR

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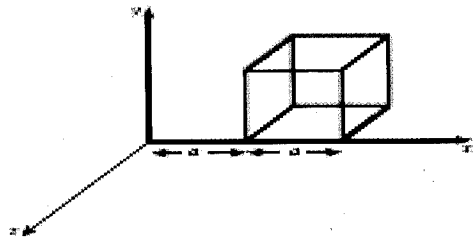
28. State Gauss's law in electrostatic. A cube with each side '**a**' is kept in an electric field given by $\vec{E} = \mathbf{C} \times \hat{\imath}$, (as is shown in the figure) where **C** is a positive dimensional constant. Find out (i) the electric flux through the cube, and 3
(ii) the net charge inside the cube.



29. Draw a labeled diagram of a moving coil galvanometer. Describe briefly its principle and working. 3
Why is it necessary to introduce a cylindrical soft iron core inside the coil of a galvanometer?

30. A source of AC voltage $V = V_0 \sin\omega t$ is connected to a series combination of resistor '**R**' and a capacitor '**C**'. Draw the phasor diagram and use it to obtain the expression for (a) impedance of the circuit and (b) phase angle. 3

OR

Explain the meaning of the term mutual inductance. Consider two concentric circular coils, one of radius $\mathbf{r_1}$ and other of radius $\mathbf{r_2}$ ($\mathbf{r_1 > r_2}$) placed coaxially with centers coinciding with each other. Obtain the expression for the mutual inductance of the arrangement.

31. Name the parts of the electromagnetic spectrum which is 3
(a) suitable for radar systems used in aircraft navigation.
(b) used to treat muscular strain
(c).used as a diagnostic tool in medicine.
Write in brief, how these waves can be produced.

32. A compound microscope has an objective lens of focal length **1.25** cm and eyepiece of focal length **5** cm. 3
A small object is kept at **2.5** cm from the objective lens. If final image is formed at infinity, find the distance between the objective lens and the eyepiece.

33. (a) Describe, with the help of a circuit diagram, the working of Zener diode as a voltage regulator. 3

(b) Give two advantages of using LEDs over conventional incandescent lamps.

34. 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. 3

Write two important conclusions which you can draw regarding the nature of the nuclear forces.

SECTION - D

35. (a) Using photon picture of light, show how Einstein's photoelectric equation can be established. Write two features of photoelectric effect which cannot be explained by wave theory. 5

(b) A proton and **α**- particle have the same de-Broglie wavelength. Determine the ratio of their accelerating potentials.

OR

Using Bohr's postulates, obtain the expression for the total energy of the electron in the stationary states of the hydrogen atom. Hence draw the energy level diagram showing how the line spectra corresponding to Balmer series occur due to transition between energy levels.

36. (a) Derive an expression for the electric **E** due to a dipole of length **' 2a'** at a point distant **r** from the centre of the dipole on the axial line. 5

(b) Draw a graph of **E** versus **r** for **r >> a**.

(c) If this dipole were kept in a uniform external electric field $\mathbf{E_0}$, diagrammatically represent the position of the dipole in stable and unstable equilibrium and write the expressions for the torque acting on the dipole in both the cases.

OR

(a) Define the drift velocity and relaxation time.

(b) On the basis of electron drift, derive an expression for resistivity in terms of number density of free electrons and relaxation time.

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

37. (a) Draw a ray diagram to show refraction of ray of monochromatic light passing through a glass prism. Deduce the expression for the refractive index of glass in terms of angle of prism and angle of minimum deviation. 5

(b) Draw a ray diagram showing the formation of image by a reflecting type telescope.

OR

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

(b) Describe any two characteristic features which distinguish between interference and diffraction phenomena.

End of the Question Paper