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SET A



# INDIAN SCHOOL MUSCAT

## FIRST PERIODIC TEST-2023

### PHYSICS

CLASS: XII

Sub. Code: 042

Time Allotted: 50mts.

16.04.2023

Max .Marks: 20

#### GENERAL INSTRUCTIONS:

- (i) All questions are compulsory.
- (ii) You may use the following values of physical constants where ever necessary.

$$m_e = 9.1 \times 10^{-31} \text{ kg}, \quad e = 1.6 \times 10^{-19} \text{ C}, \quad \epsilon_0 = 8.854 \times 10^{-12} \text{ C}^2 \text{N}^{-1} \text{m}^{-2}$$

#### SECTION-A

1. Smallest charge that can exist in nature is the charge of an electron. During friction it is only  $4 \times 1$  transfer of electrons which makes the body charged. Hence net charge on anybody is an integral multiple of charge of an electron.

$$q = \pm ne, \quad \text{where } n = \pm 1, \pm 2, \pm 3, \dots \text{ and } e = 1.6 \times 10^{-19} \text{ C}$$

Electrons are always transferred in integral values from one object to another object.

- (i) Which of the following properties is not satisfied by an electric charge?

- |                               |                            |
|-------------------------------|----------------------------|
| (a) Total charge conservation | (b) Quantization of charge |
| (c) Two types of charge       | (d) Circular line of force |

- (ii) Which of the following charges is possible?

- |                                     |                                      |
|-------------------------------------|--------------------------------------|
| (a) $5.8 \times 10^{-18} \text{ C}$ | (b) $3.2 \times 10^{-18} \text{ C}$  |
| (c) $4.5 \times 10^{28} \text{ C}$  | (d) $6.25 \times 10^{-19} \text{ C}$ |

- (iii) If a charge on a body is  $1 \text{ nC}$ , then how many electrons are present on the body?

- |                           |                          |
|---------------------------|--------------------------|
| (a) $6.25 \times 10^{27}$ | (b) $1.6 \times 10^{19}$ |
| (c) $6.25 \times 10^{28}$ | (d) $6.25 \times 10^9$   |

OR

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What is the value of charge on a body that carries 30 excess electrons?

- (a)  $-1.6 \times 10^{-18} \text{ C}$  (b)  $-3.2 \times 10^{-18} \text{ C}$   
(c)  $-4.8 \times 10^{-18} \text{ C}$  (d) None of these

(iv) A polythene piece rubbed with wool is found to have negative charge of  $3.2 \times 10^{-7} \text{ C}$ . Calculate the number of electrons transferred.

- (a)  $2 \times 10^{12}$  (b)  $3 \times 10^{12}$   
(c)  $2 \times 10^{14}$  (d)  $3 \times 10^{14}$

### SECTION-B

2. A point charge  $+Q$  is placed in the vicinity of a conducting surface. Draw the electric field lines between the surface and the charge. 2
3. Write the expression for the torque acting on an electric dipole in vector form and specify its direction. Identify two pairs of perpendicular vectors in the expression. 2
4. (i) Why do the electrostatic field lines not form closed loops? 2  
(ii) Two identical conducting balls A and B have charges  $-Q$  and  $+3Q$  respectively. They are brought in contact with each other and then separated by distance 'd' apart. Find the nature of the Coulomb force between them.
5. Is the force acting between two point charges  $q_1$  and  $q_2$  kept at some distance in air, attractive or repulsive, when: (i)  $q_1 q_2 > 0$ , (ii)  $q_1 q_2 < 0$ ? 2
6. Define electric dipole moment. Write its S.I. unit. Is it a scalar or vector quantity? 2

### SECTION-C

7. Derive an expression for the electric field intensity at any point on the equatorial line of an electric dipole. What is the direction of resultant electric field intensity at any point on the equatorial line of an electric dipole? 3
8. Two identical charges,  $Q$  each, are kept at a distance ' $r$ ' from each other. A third charge ' $q$ ' is placed on the line joining the above two charges such that all the three charges are in equilibrium. What is the magnitude, sign and position of the charge ' $q$ '? 3

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SET B



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#### GENERAL INSTRUCTIONS:

- (i) All questions are compulsory.
- (ii) You may use the following values of physical constants where ever necessary

$$m_e = 9.1 \times 10^{-31} \text{ kg}, \quad e = 1.6 \times 10^{-19} \text{ C}, \quad \epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2 \text{N}^{-1} \text{m}^{-2}$$

#### SECTION-A

1. Smallest charge that can exist in nature is the charge of an electron. During friction it is only 4×1 transfer of electrons which makes the body charged. Hence net charge on anybody is an integral multiple of charge of an electron.

$$q = \pm ne, \text{ where } n = \pm 1, \pm 2, \pm 3, \dots \text{ and } e = 1.6 \times 10^{-19} \text{ C}$$

Electrons are always transferred in integral values from one object to another object.

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| (c) $4.5 \times 10^{28} \text{ C}$  | (d) $6.25 \times 10^{-19} \text{ C}$ |

- (ii) Which of the following properties is not satisfied by an electric charge?

- |                               |                            |
|-------------------------------|----------------------------|
| (a) Total charge conservation | (b) Quantization of charge |
| (c) Two types of charge       | (d) Circular line of force |

- (iii) A polythene piece rubbed with wool is found to have negative charge of

$3.2 \times 10^{-7} \text{ C}$ . Calculate the number of electrons transferred.

- |                        |                        |
|------------------------|------------------------|
| (a) $2 \times 10^{12}$ | (b) $3 \times 10^{12}$ |
|------------------------|------------------------|

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(c)  $2 \times 10^{14}$

(d)  $3 \times 10^{14}$

(iv) If a charge on a body is 1nC, then how many electrons are present on the body?

(a)  $6.25 \times 10^{27}$

(b)  $1.6 \times 10^{19}$

(c)  $6.25 \times 10^{28}$

(d)  $6.25 \times 10^9$

**OR**

What is the value of charge on a body that carries 30 excess electrons?

(a)  $-1.6 \times 10^{-18} \text{ C}$

(b)  $-3.2 \times 10^{-18} \text{ C}$

(c)  $-4.8 \times 10^{-18} \text{ C}$

(d) None of these

**SECTION-B**

2. (i) An electrostatic field line is a continuous curve. That is, a field line cannot have sudden breaks. Why is it so? 2  
(ii) Explain why two electrostatic field lines never cross each other at any point.
3. Define electric dipole moment. Write its S.I. unit. What is the direction of electric dipole moment? 2
4. Is the force acting between two point charges  $q_1$  and  $q_2$  kept at some distance in air, attractive or repulsive, when: (i)  $q_1 q_2 < 0$ , (ii)  $q_1 q_2 > 0$ , 2
5. In a type of charge configuration electric field at a point due to it is (i) inversely proportional to square of the distance from the point (ii) inversely proportional to the cube of distance from the point. Identify the type of charge configuration in each case. 2
6. Draw the pattern of electric field lines, when a point charge  $-Q$  is kept near an uncharged conducting plate. 2

**SECTION-C**

7. An electric dipole is held in a uniform electric field. 3
  - (i) Using suitable diagram show that it does not undergo any translatory motion, and
  - (ii) Derive an expression for torque acting on it and specify its direction.
8. The sum of two point charges is  $7 \mu\text{C}$ . They repel each other with a force of 1 N when kept 30cm apart in free space. Calculate the value of each point charge. 3



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#### SECTION-A

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Electrons are always transferred in integral values from one object to another object.

- If a charge on a body is  $1 \text{ nC}$ , then how many electrons are present on the body?

- |                           |                          |
|---------------------------|--------------------------|
| (a) $6.25 \times 10^{27}$ | (b) $1.6 \times 10^{19}$ |
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#### OR

What is the value of charge on a body that carries 30 excess electrons?

- |                                      |                                      |
|--------------------------------------|--------------------------------------|
| (a) $-1.6 \times 10^{-18} \text{ C}$ | (b) $-3.2 \times 10^{-18} \text{ C}$ |
| (c) $-4.8 \times 10^{-18} \text{ C}$ | (d) None of these                    |

- A polythene piece rubbed with wool is found to have negative charge of

$3.2 \times 10^{-7} \text{C}$ . Calculate the number of electrons transferred.

(a)  $2 \times 10^{12}$

(b)  $3 \times 10^{12}$

(c)  $2 \times 10^{14}$

(d)  $3 \times 10^{14}$

(iii) Which of the following properties is not satisfied by an electric charge?

(a) Total charge conservation

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(c) Two types of charge

(d) Circular line of force

(iv) Which of the following charges is possible?

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(c)  $4.5 \times 10^{28} \text{C}$

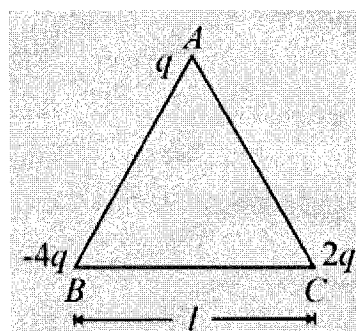
(d)  $6.25 \times 10^{-19} \text{C}$

### SECTION-B

2. In a type of charge configuration electric field at a point due to it is (i) inversely proportional to the cube of distance from the point (ii) inversely proportional to square of the distance from the point. Identify the type of charge configuration in each case. 2
3. Write any two differences between gravitational force and electrostatic force. 2
4. Define electric dipole moment. Write its S.I. unit. What is the direction of electric dipole moment? 2
5. Write the expression for the torque acting on an electric dipole in vector form and specify its direction. Identify two pairs of perpendicular vectors in the expression. 2
6. A point charge  $+Q$  is placed in the vicinity of a conducting surface. Draw the electric field lines between the surface and the charge. 2

### SECTION-C

7. Three point charges  $q$ ,  $-4q$  and  $2q$  are placed at the vertices of an equilateral triangle ABC of side ' $l$ ' as shown in the figure. Obtain the expression for the magnitude of the resultant electric force acting on the charge  $q$ . 3



8. Derive an expression for the electric field intensity at any point on the axial line of an electric dipole. What is the direction of resultant electric field intensity at any point on the axial line of an electric dipole? 3