5.1 Electric Fields

Question Paper

Course	DP IB Physics
Section	5. Electricity & Magnetism
Topic	5.1 Electric Fields
Difficulty	Medium

Time allowed: 20

Score: /10

Percentage: /100

Question 1

Two separated, identical conducting spheres X and Y of charge −8 μC and +12 μC respectively, are brought into brief contact and then separated. What is the final charge distribution on X and Y?

	X / μC	Y / μC
A.	-8	+12
B.	+10	+10
C.	+2	+2
D.	-4	+6

[1 mark]

Question 2

Which of the following statements about electric fields and potential differences is incorrect?

A. The presence of a potential difference requires an electric field

B. Work on or by an electron across a potential difference V is eV

C. Work on or by an electron across a potential difference is path dependent

D. The electric field is a vector field

[1 mark]

Question 3

A proton of mass m_p and charge q is accelerated from rest across a potential difference, V of 5×10^{-2} V. What is the best estimate for the magnitude of the proton's final velocity, v_p?

A. $v_p = \sqrt{\frac{2qV}{m_p}}$

B. $v_p = \frac{2qV}{m_p}$

C. $v_p = \frac{qV}{2m_p}$

D. $v_p = qV$

[1 mark]

Question 4

The Tolman-Stewart experiment sought to find evidence that mobile charge carriers inside conducting metals are negatively charged.

It involved exploiting the inertia of 'free' charge carriers in the conductor. If the conductor was suddenly accelerated, a potential difference would be set up.

Assuming positive charges are fixed in place and mobile charge carriers are negative, which of the following statements about the Tolman-Stewart experiment is incorrect?

A. Accelerating the conductor created an area of excess negative charge in it

B. Accelerating the conductor created an area of excess positive charge in it

C. Electrons have inertia

D. The potential difference created by the acceleration was not measurable

[1 mark]

Question 5

A point charge q is placed near a large spherical charge $Q = 10q$. What is the magnitude of the force experienced by q and Q and the magnitude of the electric field E created by Q at the position of q?

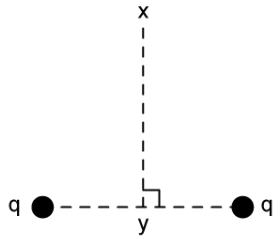
	Magnitude of force experienced by q	**Magnitude of force experienced by Q**	**Magnitude of E created by Q at position of q**
A.	F	F	$\frac{F}{q}$
B.	$10F$	$0.1F$	$\frac{F}{q}$
C.	F	F	$\frac{F}{Q}$
D.	$0.1F$	$10F$	$\frac{F}{Q}$

[1 mark]

Question 6

Two identical point charges *q* create a resultant electric field at **X**.

The line XY is a perpendicular bisector of the line joining both point charges.



Which vector most accurately depicts the direction of the resultant electric field at **X**?

A. →

B. ↑

C. ←

D. ↓

[1 mark]

Question 7

The electron drift speed in a copper wire of diameter 2.0 mm is 3×10^{-4} m s^{-1}. Typically, the number of free electrons per unit volume for copper is on the order of magnitude 10^{28} m^{-3}. What is the best estimate for the current in the wire?

A. 480π A

B. 0.48 A

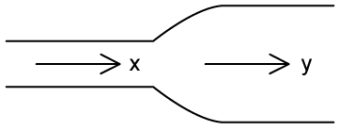
C. 0.48π A

D. 19.2 π A

[1 mark]

Question 8

A conducting wire, carrying current flowing from **X** to **Y**, has a non-uniform cross-sectional area.



Which statement is incorrect?

A. The current at **X** and **Y** is equal

B. The drift speed at **X** is equal to the drift speed at **Y**

C. The charge density at **X** is equal to the charge density at **Y**

D. Charge is conserved at **X** and at **Y**

[1 mark]

Question 9

Two charges, $Q_1 = q$ and $Q_2 = 4q$ are separated by a distance r and exert a force of magnitude F on each other. By what factor does the magnitude of the force change if the charge on Q_1 doubles and the separation distance trebles?

A. $\frac{1}{9}$

B. $\frac{2}{3}$

C. $\frac{2}{9}$

D. 2

[1 mark]

Question 10

What is the definition of electric current?

A. The ratio of potential difference across a component to the resistance of the component

B. The rate of flow of electric charge

C. The energy transferred per unit of charge flowing through a component

D. The chemical energy transferred to electrical energy per unit of charge flowing in a cell

[1 mark]