

1 (a) (i) State what is meant by the *direction* of an electric field.

.....
.....[1]

(ii) Fig. 9.1 shows a pair of oppositely-charged horizontal metal plates with the top plate positive.

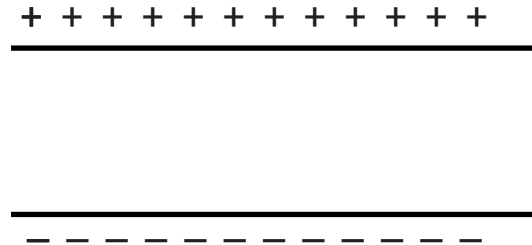


Fig. 9.1

The electric field between the plates in Fig. 9.1 is uniform.

Draw lines on Fig. 9.1 to represent this uniform field. Add arrows to these lines to show the direction of the field. [3]

(b) Fig. 9.2 shows a very small negatively-charged oil drop in the air between a pair of oppositely charged horizontal metal plates. The oil drop does not move up or down.

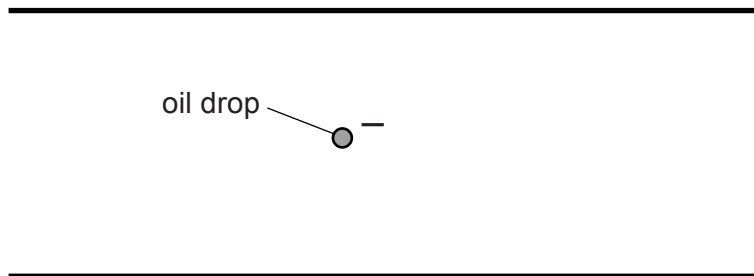


Fig. 9.2

(i) Suggest, in terms of forces, why the oil drop does not move up or down.

.....
.....[2]

(ii) Without losing any of its charge, the oil drop begins to evaporate.

State and explain what happens to the oil drop.

.....
.....[2]

[Total: 8]

- 2 A plastic rod is rubbed with a cloth and becomes positively charged. After charging, the rod is held close to the suspended table-tennis ball shown in Fig. 9.1. The table-tennis ball is covered with metal paint and is uncharged.

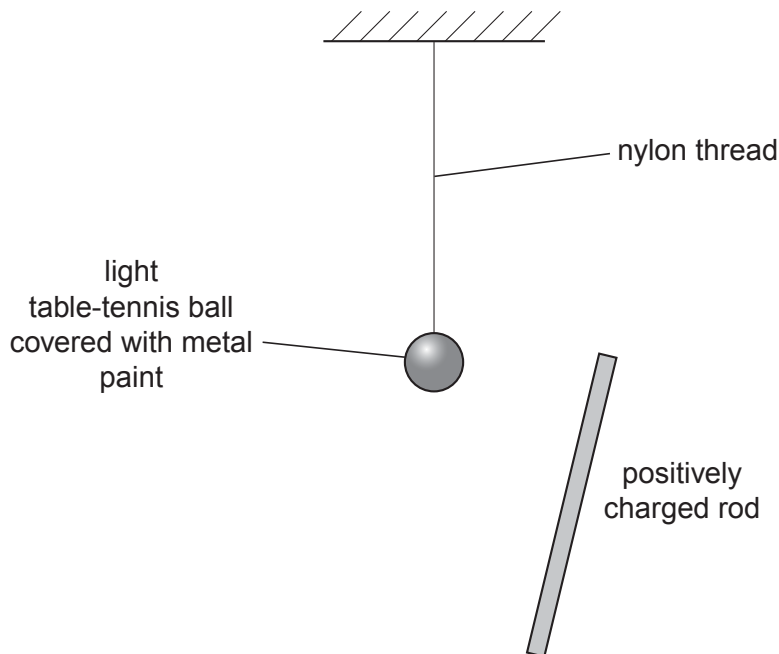


Fig. 9.1

- (a) Describe what happens to the charges in the metal paint on the ball as the positively charged rod is brought close to the ball.

.....
.....
..... [1]

- (b) The ball is attracted towards the charged rod.

Explain why this happens, given that the ball is uncharged.

.....
.....
..... [2]

- (c) State the unit in which electric charge is measured.

..... [1]

[Total: 4]

3 Fig. 10.1 shows two parallel conducting plates connected to a very high voltage supply.

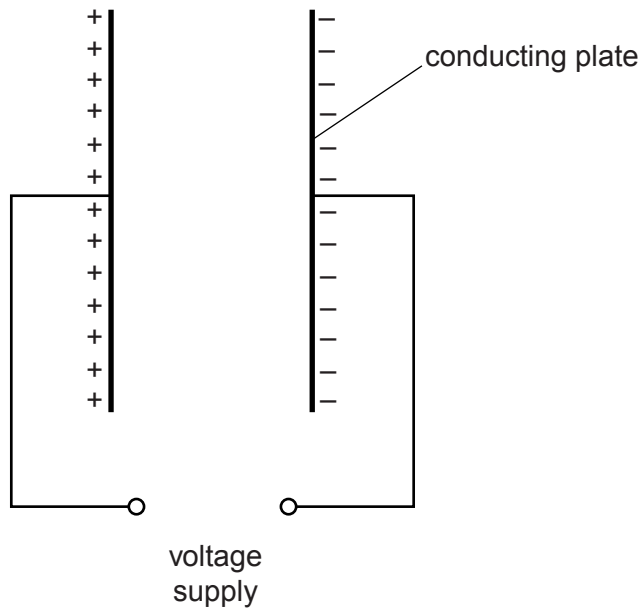


Fig. 10.1

The left-hand plate is positively charged and the right-hand plate is negatively charged.

- (a) On Fig. 10.1, draw the electric field pattern produced between the charged plates. Use arrows to show the direction of the field. [2]
- (b) A light, conducting ball is suspended by an insulating string. Fig. 10.2 shows the ball in the middle of the gap between the plates.

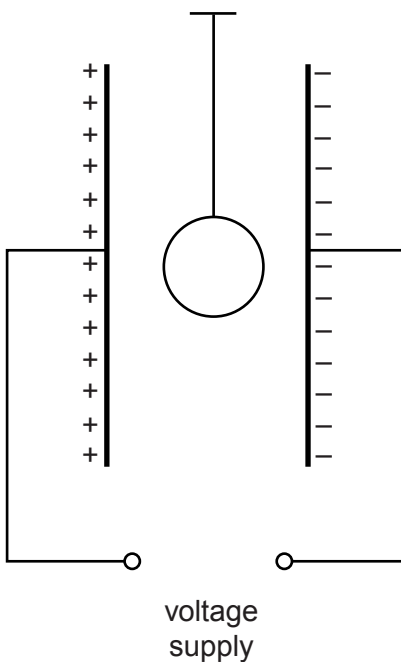


Fig. 10.2

On Fig. 10.2, show the distribution of charge on the ball.
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[2]

(c) The ball is displaced to the left and then oscillates backwards and forwards between the two plates.

The ball touches a plate once every 0.05s. Every time it touches a plate, a charge of $2.8 \times 10^{-8}\text{C}$ (0.000 000 028C) is transferred.

Calculate the average current produced by the repeated transfer of charge.

current = [2]

[Total: 6]

- 4 Fig. 8.1 shows a circuit containing a battery of electromotive force (e.m.f.) 12V and a heater of resistance $6.0\ \Omega$.

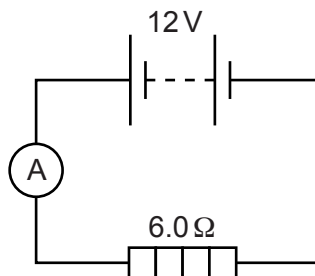


Fig. 8.1

- (a) State what is meant by electromotive force (e.m.f.).

.....
 [1]

- (b) (i) Calculate the current in the heater.

current = [2]

- (ii) State the name of the particles that flow through the heater.

..... [1]

- (iii) On Fig. 8.1, draw an arrow next to the heater symbol to show the direction of flow of these particles through the heater. [1]

- (c) Calculate the thermal energy produced in the heater in 10 minutes.

thermal energy = [2]

[Total: 7]

- 5 A digital watch is powered by a 1.3V cell. The cell supplies a current of 4.1×10^{-5} A (0.000041 A) for 1.6×10^7 s.

Calculate

- (a) the charge that passes through the cell in this time,

charge =[2]

- (b) the resistance of the electrical circuit in the watch,

resistance =[2]

- (c) the output power of the cell.

power =[2]

[Total: 6]

6 A metal sphere, mounted on an insulating plastic stand, is positively charged.

(a) State the name of the unit in which electric charge is measured.

.....[1]

(b) A smaller metal sphere, also mounted on an insulating plastic stand, is uncharged.

This smaller sphere is moved close to the positively charged sphere. Fig. 8.1 shows the two spheres.

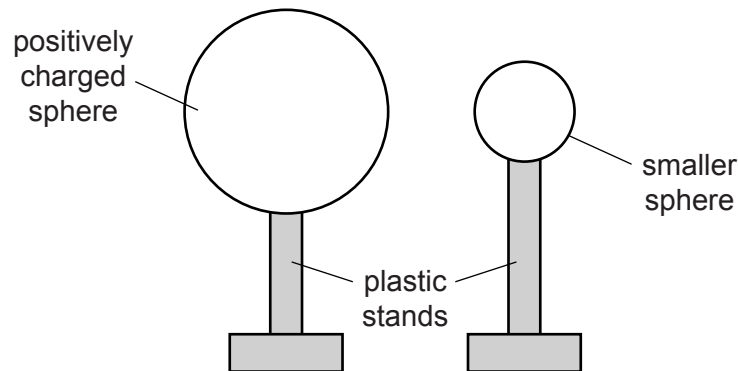


Fig. 8.1

(i) On Fig. 8.1, draw the distribution of charge on the smaller sphere. [2]

(ii) An earthed metal wire is touched against the smaller metal sphere.

State and explain what happens to the charge on the smaller sphere.

.....
.....
.....[2]

(c) Explain, in terms of their structures, why the metal wire is an electrical conductor but the plastic stand is an electrical insulator.

.....
.....
.....[2]

[Total: 7]

7 (a) (i) State what is meant by an *electric field*.

.....
..... [1]

(ii) Fig. 7.1 shows a small, positively charged sphere.



Fig. 7.1

On Fig. 7.1, sketch the pattern of the electric field in the space around the sphere. [2]

(b) Fig. 7.2 shows a metal sphere on an insulating support.

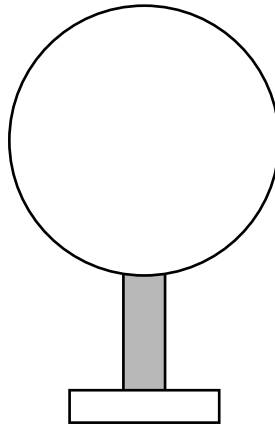


Fig. 7.2

A student has available two rods, one charged positively and one charged negatively. Using one of these rods, she gives the sphere a uniform negative charge by induction.

State which rod she chooses, and describe the procedure she follows.

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 7]

- 8 (a) A solenoid connected to a battery produces a magnetic field. The wires are then connected to the battery terminals the other way round.

Tick **one** box in the table to indicate the effect on the magnetic field.

decreases but not to zero	
decreases to zero	
reverses direction	
increases	
stays the same	

[1]

- (b) Fig. 7.1 shows a top view of two bar magnets and a vertical rigid conducting rod carrying a current. The direction of the current in the rod is coming **out of the paper**.



⊙ — vertical rod perpendicular to paper



Fig. 7.1

- (i) On Fig. 7.1, draw a single line with an arrow to show the direction of the magnetic field due to the bar magnets at the position of the rod. [2]
- (ii) State the direction of the force exerted on the vertical rod. [2]

..... [2]

- (c) The rod has a mass of 350 g and the resultant force acting on the rod is 0.21 N. The rod is free to move.

Calculate the initial acceleration of the rod.

acceleration = [2]

[Total: 7]