Write your name, centre number and candidate number in the boxes below.

Surname	Other names

Centre number | | | | | |

Candidate number | | | | |

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Static electricity

Time allowed: 1 hour 5 minutes

Subject code **0625**

Physics

Questions from Paper 3 and Paper 4

You must have: a ruler marked in centimetres and millimetres, a protractor, compasses, a pen, an HB pencil and an eraser.

Total marks

/ 66

Instructions

- Answer every question in the space provided on this paper.
- Write in black or dark blue ink. Pencil may be used for diagrams and graphs.
- Fill in your name, centre number and candidate number above.
- Show your working: a correct method can earn marks even if the answer is wrong.

Information

- This paper has 10 questions worth 66 marks in total.
- The marks for each question or part are shown in brackets, for example [3].

Advice

- Read every question through once before you write anything.
- Use the marks in brackets to judge how long to spend on each part.
- If you finish early, go back and check your working.

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Print at 100% (Actual size) so diagrams keep their real measurements.

1 **(a)** Fig. 10.1 shows a balloon hanging from an insulating thread.

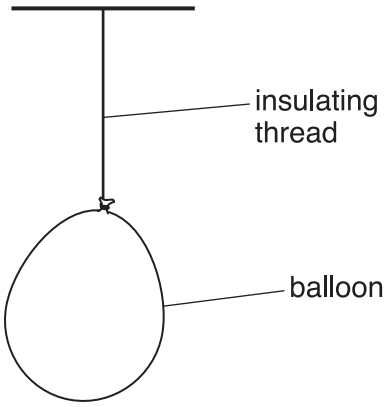


Fig. 10.1

(i) A student gives the balloon a positive charge.

Which statement explains why the balloon becomes positively charged? Tick **one** box.

- ☐ The balloon gains electrons
- ☐ The balloon loses electrons
- ☐ The balloon gains protons
- ☐ The balloon loses protons [1]

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(ii) The student brings a charged rod close to the balloon as shown in Fig. 10.2.

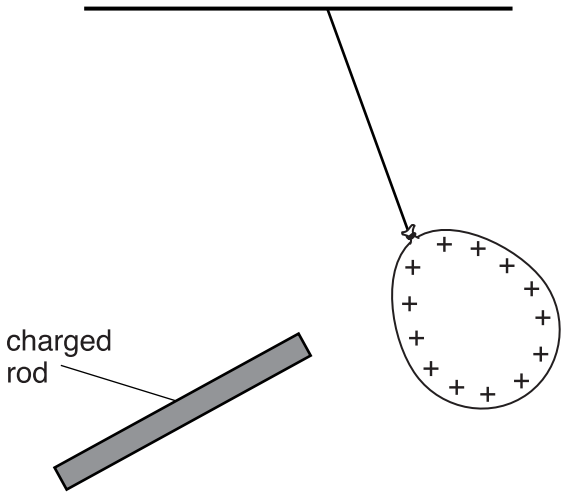


Fig. 10.2

State the type of charge on the rod.

.....

Explain your answer.

.....

.....

[2]

(b) Electrical charges can move easily through some materials.

Draw a circle around each material that charges can move through easily.

copper plastic rubber silver wood [1]

[Total: 4]

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Reduced to 77% to fit the page (wider than A4).

1(a)(i)	second box (The balloon loses electrons) ticked	**1**
1(a)(ii)	positive (charge)	**1**
	like charge(s) repel	**1**
1(b)	circle around copper **AND** silver	**1**

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2 **(a)** Fig. 8.1 represents charges on an acetate strip and on a dry cloth.
Both the acetate strip and the dry cloth are electrically neutral.

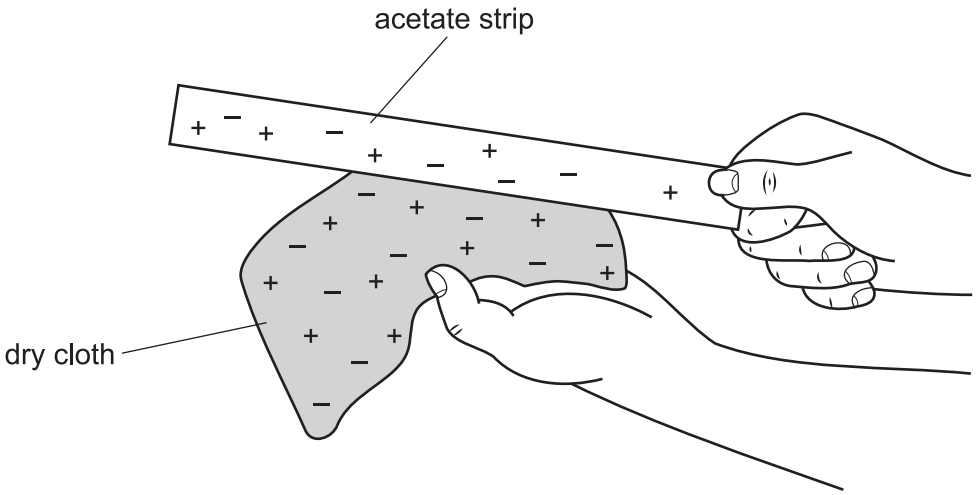


Fig. 8.1

The student charges the acetate strip by using the dry cloth. The acetate strip becomes positively charged.
Explain how the acetate strip becomes positively charged.

.....

.....

.....

.....

..... [3]

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(b) The student brings the positively charged acetate strip close to another positively charged acetate strip. Fig. 8.2 shows this situation.

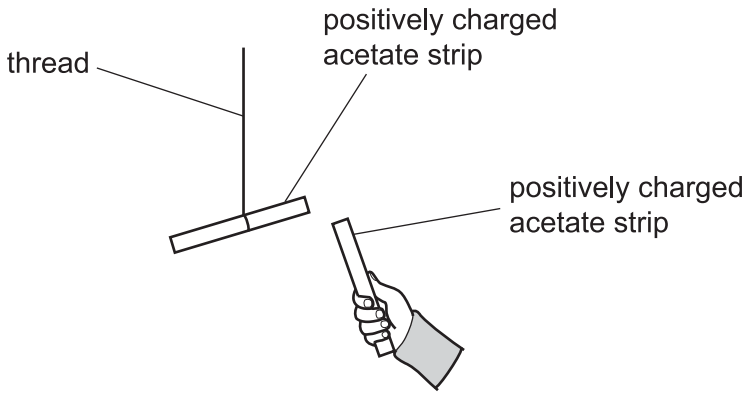


Fig. 8.2

Describe and explain what happens when the two positively charged acetate strips are close to each other.

.....

.....

..... [2]

[Total: 5]

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Reduced to 78% to fit the page (wider than A4).

2(a)	friction OR rubbing (with cloth) owtte	**B1**
	electrons / negative charges move / transfer	**M1**
	from the acetate OR to the cloth	**A1**
2(b)	(strips) repel / move away (from each other) owtte	**M1**
	same charge (on both strips) / <u>both / they</u> have positive charge	**A1**

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3 Fig. 8.1 shows two uncharged (neutral) plastic spheres. Each sphere is suspended by an insulating thread.

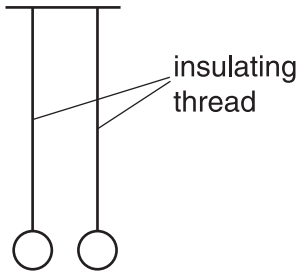


Fig. 8.1

(a) Suggest a material for the insulating threads.

..... [1]

(b) The spheres can be given a charge.

Three different experiments are carried out using the arrangements shown in Fig. 8.2.

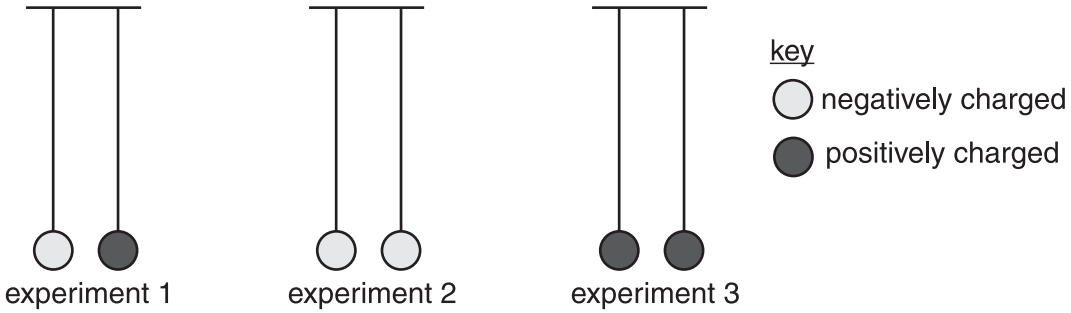


Fig. 8.2

For each experiment, describe the force, if any, between the spheres.

experiment 1 .....

experiment 2 .....

experiment 3 .....

[3]

(c) State and explain how one of the plastic spheres can be given a positive charge.

.....

.....

..... [2]

[Total: 6]

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3(a)	any named insulator, e.g. cotton, string etc.	**B1**
3(b)	1 = attract	**B1**
	2 = repel	**B1**
	3 = repel	**B1**
3(c)	(sphere) is rubbed with a cloth	**B1**
	electrons move off (sphere) owtte	**B1**
	Total:	**6**

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4 Fig. 8.1 shows apparatus used to charge a metal plate by induction.

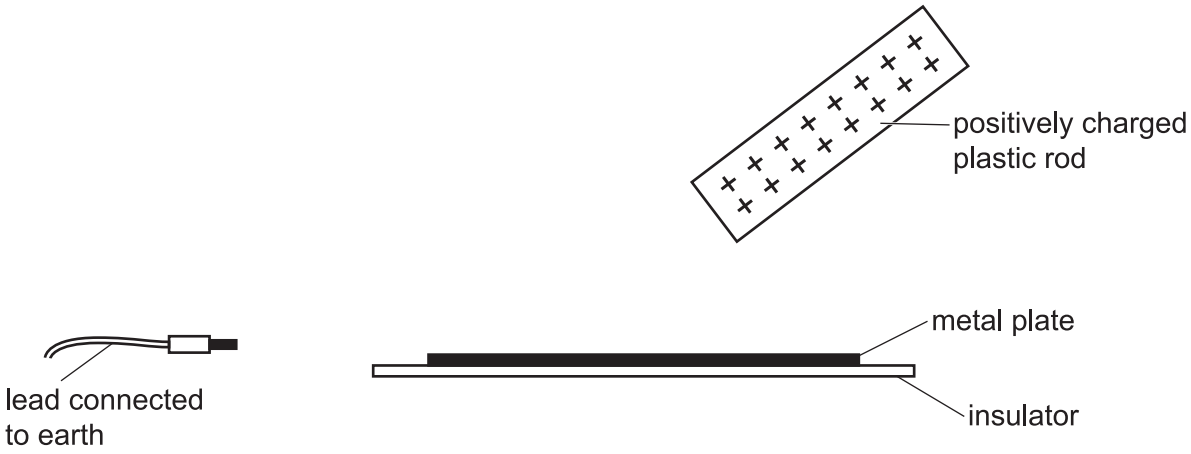


Fig. 8.1

(a) Describe and explain how the apparatus shown in Fig. 8.1 can be used to charge the metal plate.

.....

.....

.....

.....

.....

..... [4]

(b) Fig. 8.2 shows an electric circuit.

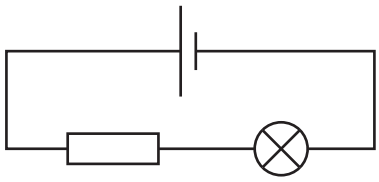


Fig. 8.2

On Fig. 8.2, draw an arrow to show the direction of flow of electrons and explain how you determined the direction.

explanation ..... [1]

[Total: 5]

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4(a)	positively charged / plastic rod is brought close to metal plate	**B1**
	negative charges / electrons (from metal plate) move to top of metal plate / close(r) to rod	**B1**
	earth lead connected to (metal) plate **AND** negative charges / electrons move on to plate	**B1**
	(at the end of the process) earth lead removed (before charged rod removed) **OR** (at the end of the process) metal plate has (net) negative charge	**B1**
4(b)	correct direction – pointing away from negative terminal / clockwise arrow **AND** current flow in opposite direction to flow of electrons	**B1**

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5 A plastic rod becomes negatively charged when it is rubbed with a woollen cloth.

(a) Describe, in terms of particles, how the rod becomes negatively charged when rubbed with the cloth.

.....

.....

..... [2]

(b) A light, conducting ball is at rest on a metal table. When the rod is brought close to the ball, as shown in Fig. 7.1, the ball jumps up towards the rod.

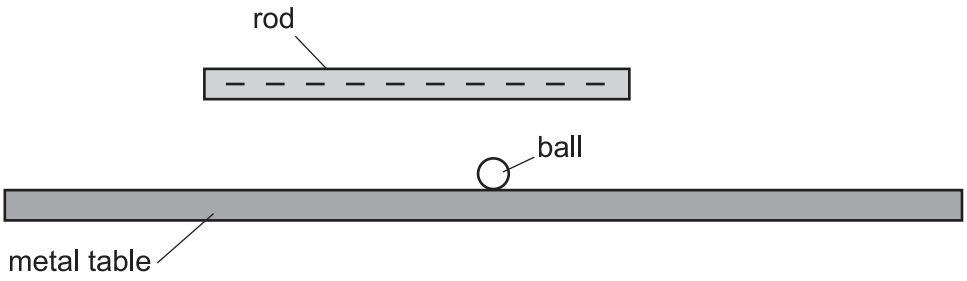


Fig. 7.1

(i) Explain why the ball jumps up.

.....

.....

.....

..... [3]

(ii) The ball touches the rod and falls back down to the table.

Explain why this happens.

.....

.....

..... [2]

[Total: 7]

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5(a)	electrons mentioned	**B1**
	negative charges / electrons move from cloth **or** move to rod	**B1**
5(b)(i)	electrons / negative charge(s) repelled to earth **or** ball charged by induction	**B1**
	ball positively charged	**B1**
	opposite charges attract	**B1**
5(b)(ii)	negatively charged (by rod) **or** ball discharges / becomes neutral	**B1**
	repelled by rod **or** pulled down by gravity / its weight	**B1**

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6 **(a)** A student rubs one side of an inflated balloon on her hair. This side of the balloon becomes positively charged. Explain this.

.....

.....

..... [2]

(b) The charged side of the balloon is now brought close to a stream of water flowing from a pipe. The original position of the stream of water is shown in Fig. 8.1.

On Fig. 8.1, write in the boxes to indicate how each side of the stream of water is electrically charged.

Choose your answer in each case from: positive, negative or neutral.

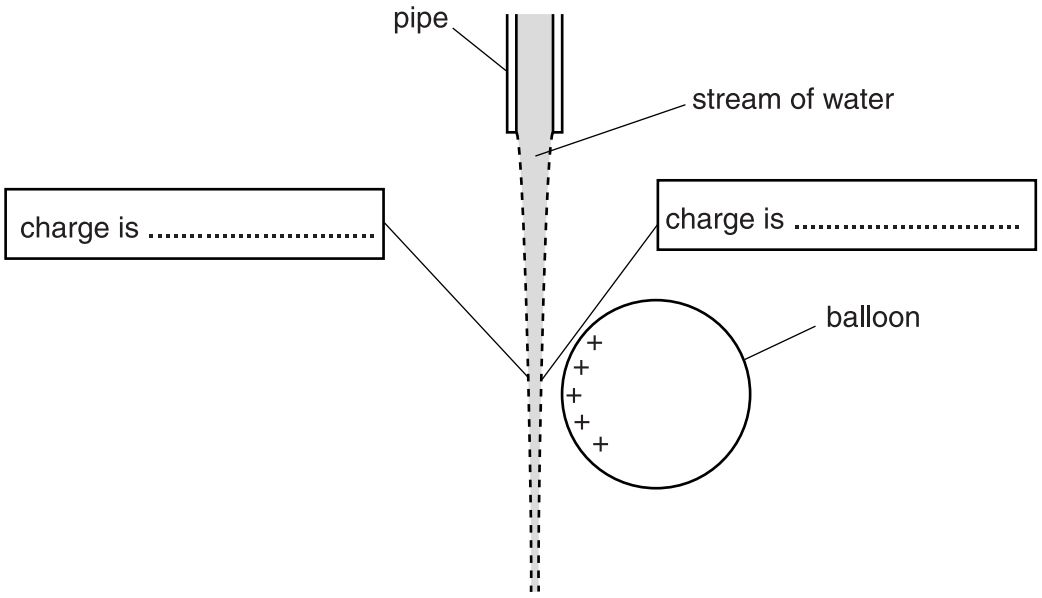


Fig. 8.1

[2]

(c) On Fig. 8.1, draw the new position of the stream of water. Explain this new position.

.....

.....

.....

..... [2]

(d) Explain why rubbing one side of a metal sphere does not cause it to become charged.

.....

..... [1]

[Total: 7]

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6 **(a)** ignore moving positive charge
electrons/negative charges removed from balloon NOT attracted to hair M1
moved to hair/hair becomes negatively charged/idea of net positive charge on balloon A1 [2]

(b) charge on left: positive/neutral B1
charge on right: negative B1 [2]

(c) stream deflected to right in diagram M1
(negative) charges in water stream attracted by (charges on) balloon A1 [2]

(d) metal (good) conductor/has free electrons o.w.t.t.e. B1 [1]

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7 Fig. 8.1 shows a small, uncharged copper sphere suspended from a nylon thread, and a plastic rod being rubbed with a woollen cloth.

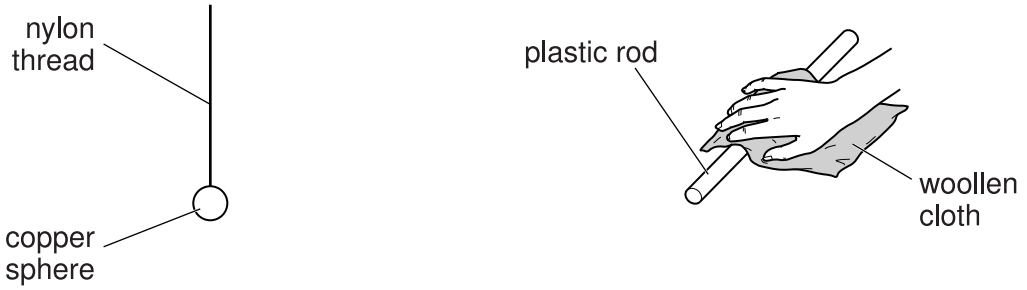


Fig. 8.1

The rod becomes negatively charged as it is rubbed.

(a) Explain, in terms of electrons, why copper is a conductor but nylon is an insulator.

.....

.....

..... [2]

(b) Describe how the negatively charged rod may be used to induce a positive charge on the copper sphere.

.....

.....

.....

..... [3]

(c) The copper sphere is given a positive charge, as shown in Fig. 8.2.



Fig. 8.2

On Fig. 8.2, draw arrows to indicate the direction and pattern of the electric field that surrounds the positively charged sphere. [2]

[Total: 7]

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7 **(a)** in copper/metals/conductors, electrons (free to move) B1
in nylon/insulators electrons fixed/not free (to move) B1

(b) (negatively charged nylon) rod near to sphere B1
earth/touch (with hand) the sphere B1
remove earth/hand (and remove rod) B1

(c) <u>at least four</u> equally spaced, radial lines from surface M1
<u>at least one</u> outward arrow AND none wrong A1 [7]

8 **(a)** Fig. 7.1 shows the electric field pattern around point X.

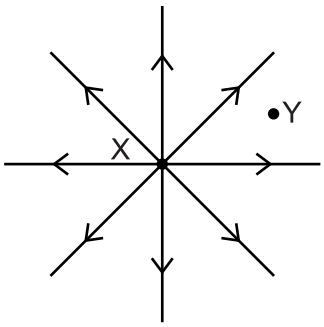


Fig. 7.1

(i) On Fig. 7.1, draw an arrow to indicate the direction of the force on a negative point charge placed at point Y. [2]

(ii) State what is at point X to produce the field pattern shown in Fig. 7.1.

.....

..... [2]

(b) A piece of plastic is charged positively by friction.

State what charge transfers occur during this process.

.....

.....

..... [2]

(c) Explain how the structure of an electrical conductor differs from the structure of an electrical insulator.

.....

..... [2]

[Total: 8]

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8(a)(i)	radial arrow	**B1**
	inward radial arrow	**B1**
8(a)(ii)	positive point charge	**A2**
	positive (charge)	C1
8(b)	electrons / negative charges (move)	**B1**
	out of (plastic) **OR** removed from / lost from (plastic)	**B1**
8(c)	any mention of free / mobile / delocalised electrons	**M1**
	conductors have free / mobile / delocalised electrons **OR** insulators do not have free / mobile / delocalised electrons	**A1**

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9 In Fig. 9.1, A and B are two conductors on insulating stands. Both A and B were initially uncharged.

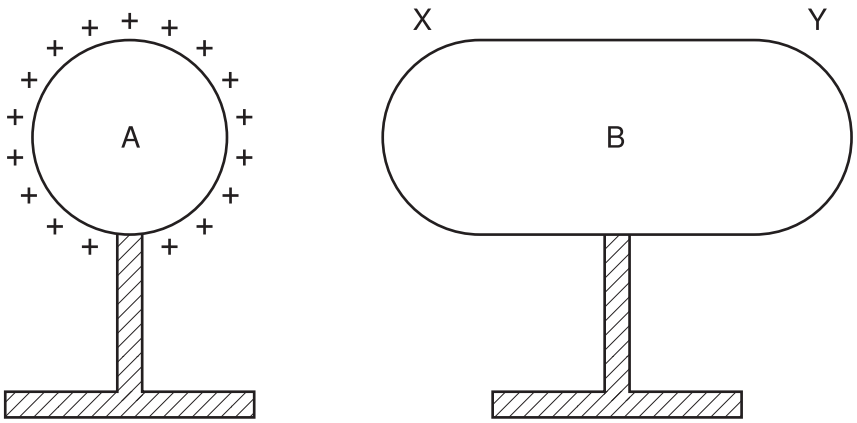


Fig. 9.1

(a) Conductor A is given the positive charge shown on Fig. 9.1.

(i) On Fig. 9.1, mark the signs of the charges induced at end X and at end Y of conductor B. [1]

(ii) Explain how these charges are induced.

.....

.....

..... [3]

(iii) Explain why the charges at X and at Y are equal in magnitude.

.....

.....

..... [1]

(b) B is now connected to earth by a length of wire.

Explain what happens, if anything, to

(i) the charge at X,

.....

..... [1]

(ii) the charge at Y.

.....

..... [2]

[Total: 8]

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9	**(a)**	**(i)**	negative at LH end **and** positive at RH end	B1
		(ii)	(+ve) charge on A attracts electrons/-ve charges/-ve ions OR unlike charges attract (ignore reference to + charges) electrons move to end X/towards A (unbalanced) +ve charges (left) at end Y NOT repelled to Y	 B1 B1 B1
		(iii)	idea that each electron leaves behind an equal unbalanced proton in nucleus/B has no net charge/B is neutral/idea that B has not gained or lost any charges	B1
	(b)	**(i)**	nothing OR nothing implied	B1
		(ii)	+ve charge cancelled/neutralised by electrons/negative charges flowing up from earth	B1 B1

[Total: 8]

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10 **(a)** **(i)** Describe what is meant by an *electric field*.

.....

..... [1]

(ii) State what is meant by the *direction* of an electric field.

.....

..... [1]

(b) Fig. 8.1 shows a polystyrene ball covered with aluminium paint. The polystyrene ball is suspended between two charged metal plates by an insulated thread.

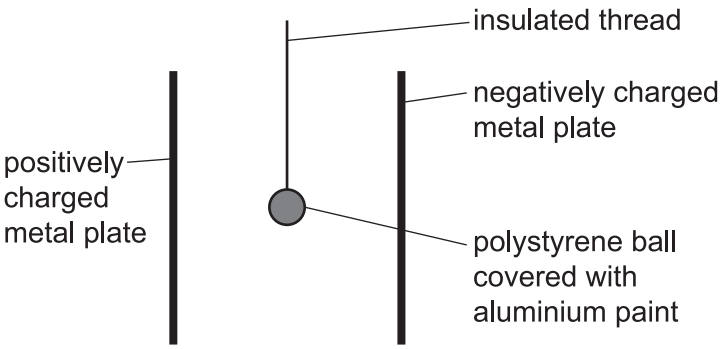


Fig. 8.1

The ball oscillates between the two charged plates.

Explain why the ball oscillates.

.....

.....

.....

.....

.....

..... [4]

(c) There is a current of 0.29A in an electrical circuit.

Calculate the time taken for a charge of 15C to flow through the electrical circuit.

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time = ... [3]

[Total: 9]

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10(a)(i)	region in which an electric charge experiences a force	**B1**
10(a)(ii)	direction of force on a positive charge	**B1**

10(b)	any **four** from: • ball moves towards positive plate • ball touches positive plate • made of conducting material so becomes positively charged • repelled from positive plate • touches negative plate and loses charge • negatively charged ball attracted back to positive plate and process repeats	**B4**
10(c)	$I = Q / t$ in any form	**C1**
	$t = Q / I$	**C1**
	$(t = 15 / 0.29 =) 52$ s	**A1**

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