PEARSON EDEXCEL GCSE PHYSICS (HIGHER) · 1PH0

PHYSICS



MARK SCHEME

TOPIC 11: STATIC ELECTRICITY

SCORE	PERCENTAGE
/59	%

STEMUP

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Mark Scheme

Q1.

Question number	Answer	Additional guidance	Mark
(i)	rub (the balloon) (1) with a piece of cloth/hair/fur (1)	use friction allow on any insulated object	**(2)**

Question number	Answer	Additional guidance	Mark
(ii)	B Negative charge has been added to the balloon A is incorrect removing negative charge would make the balloon positively charged. C and D are incorrect because positive charge cannot be moved		**(1)**

Question number	Answer	Additional guidance	Mark
(iii)	an explanation linking: method of handling balloons without discharging them (1) bring balloons near to each other (1) observation of repulsion (1)	 hang balloons up by their strings they/balloons will push away (from each other)	**(3)**

Q2.

	Answer	Acceptable answers	Mark
(a)(i)	C		**(1)**
(a)(ii)	B		**(1)**
(b)	substitution (1) 3.7 x 13 evaluation (1) 48 (C)	 48.1 Correct answer with no calculation scores 2 marks	**(2)**
(c)(i)	Correct responses can be seen in (i) or (ii) An explanation linking • <u>electrons</u> (1) and <u>one</u> of • removed by friction (1) • (transferred) <u>to</u> plastic (1)	 ["positive electrons/ protons moving", seen anywhere in part (i) or (ii) loses this mark] ignore reference to charge before rubbing transferred from cloth	**(2)**
(c)(ii)	opposite to charge on plastic (1) <u>equal</u> to charge on the plastic (1)	charge on cloth is positive <u>same size</u> as charge on plastic electrons transferred from the cloth equal to electrons lost by cloth	**(2)**

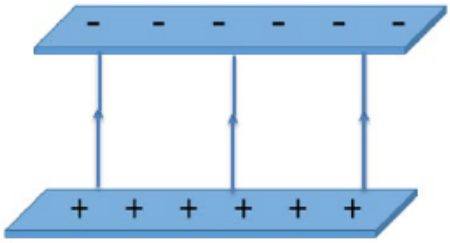
Total question = 8 marks

Q3.

Question number	Answer	Additional guidance	Mark
(i)	use friction (1)	rub (the plastic rod)	**(1)** **AO1**

Question number	Answer	Additional guidance	Mark
(ii)	C  A and B are incorrect because the cap would become charged D is incorrect because the cap would have an opposite charge to that on the rod		**(1)** **AO1**

Q4.

Question Number	Answer	Additional Guidance	Mark
	 at least three vertical straight lines (equally spaced) (1) **with** at least one arrow in the right direction (1)	judge by eye any arrow in the wrong direction = 1 mark max	**(2)**

Q5.

Question number	Answer	Additional guidance	Mark
	at least three **radial** lines from the charge (1) direction shown away from the charge (1)	do not allow curved lines ignore circles without arrows consistently	**(2)** **AO1.2**

Q6.

Question number	Answer	Additional guidance	Mark
(i)	(size of) charge on Q is greater than (size of charge) on P (1) P has (overall) negative charge and Q has (overall) positive charge (1)	in any order Q has more charge / stronger field than P accept abbreviations such as +'ve, -'ve charge on P is opposite to charge on Q	**(2)** **AO3**

Question number	Answer	Additional guidance	Mark
(ii)	(force of) attraction on (object) P from (object) Q (1)		**(1)** **AO1**

Q7.

Question Number	Answer	Acceptable answers	Mark
(a)	C (gain electrons)		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)	An explanation linking • (Force of) attraction (1) • (plates have) opposite charge (to dust) (1)	 Plates have a positive charge Ignore different charge	**(2)**

Question Number	Answer	Acceptable answers	Mark
(c)(i)	transferred to plate / lost (1)	neutral / become discharged	**(1)**

Question Number	Answer	Acceptable answers	Mark
(c)(ii)	An explanation linking any two of • Metal is a conductor (1) • Electrons / (negative) charge moves (through the plates/ wire) (1) • Towards the voltage supply / earth /ground (1)	 Metal not an insulator Plates / charges are earthed	**(2)**

Question Number	Answer	Acceptable answers	Mark
(d)	Substitution: $Q = 1.2 \times 10^{-3} \times 40$ (1) Evaluation: 0.048 or 4.8×10^{-2} (1) C / coulombs (1)	Give 2 marks for correct answer with no working shown Unit mark is independent Allow for 1 mark 48 (with incorrect or no units) Allow for 2 marks 48 C Allow for all 3 marks 48 mC	**(3)**

Q8.

Question number	Answer	Mark
	An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark): • (negatively charged) door attracts (positively charged) paint (droplets) (1) Plus any **one** of the following: • therefore (positively charged) paint (droplets) follow lines of force and coat both sides of the car door (1) • since electric field (or lines of force) directed towards the (car) door, then positive paint will move to the door (1) • as electric field (or lines of force) touches all parts of the (car) door hence the positive paint will coat all parts of the door (1)	**(2)**

Q9.

Question number	Answer	Additional guidance	Mark
	an explanation including any **three** from: the leaf (becomes) charged (1) opposite to charge on droplets / spray (1) charges on leaf are **induced** (1) opposite charges attract (1) as a result of movement of electrons (between earth and leaf) (1) idea of spray reaching parts of the back of the leaf (1) charged droplets repel each other (having the same charge) (1)	**accept marks scored on diagram** ignore polarity for this marking point states charge opposite to what they have on the leaf ignore positive electrons / charges / particles allow all over	**(3)** **AO1.1**

Q10.

Question number	Answer	Additional guidance	Mark
	An explanation linking: electrons move_(1) with **one** from: (leaf and/or rod) have been discharged (1) (gold leaf) is no longer repelled (1)	 negative charges move reject positive electrons for this mark to the earth	**(2)** **AO1**

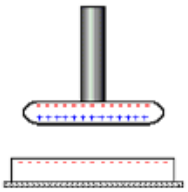
Q11.

Question number	Answer	Additional guidance	Mark
	An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (1 mark): • friction between aircraft and air (1) • causes electron transfer between aircraft and air (1)	 accept idea of air rubbing against wings ignore 'charge' and 'static' do not allow (for second mark) idea of protons moving	 **(2)**

Q12.

Question number	Answer	Additional guidance	Mark
	an explanation linking any **two** from charged by **friction** (1) electrons / negative charges rubbed off ruler (1) woolly jumper becomes negative (1)	 electrons / negative charges transfer to jumper ignore positive electrons / charges / particles	**(2)** **AO2.1**

Q13.

Question number	Answer	Additional guidance	Mark
(i)	B  A and D are incorrect because a negative charge cannot induce a negative charge C is incorrect because the disc is insulated so negative charge cannot be removed		**(1)**

Question number	Answer	Additional guidance	Mark
(ii)	an explanation linking: <u>electrons</u> / <u>negative</u> charges move/ flow/transfer (1) from the metal disc / to the student / to earth/ground (1)	reject positive charge moving for first mark accept lose electrons	**(2)**

Question number	Answer	Additional guidance	Mark
(iii)	at least three straight lines joining disc and plastic (1) arrow(s) from disc towards plastic (1)	judge by eye ignore curved lines at edge do not award mark if there are arrows in both directions	(2)

Q14.

Question Number:	Answer	Additional guidance	Mark
(i)	an explanation linking:		(2) AO 2 2
	sphere A has an electric field (1)	both spheres have electric fields	
	sphere B is in it (1)	the electric fields interact/overlap ignore nature of force; e.g. repulsion	

Question Number:	Answer	Additional Guidance	Mark
(ii)	a description to include:		(2) AO 3 1a AO 3 1b
	as the distance increases the force (on the sphere B) decreases (1)	negative correlation	
	the greatest change is at smallest distances (1)	non-linear gradient changes allow named non-linear functions such as exponential / inversely proportional in this context reference to inverse square law scores 2 marks	

Q15.

Question number	Answer	Mark
	B negative | positive	**(1)**

Q16.

	Answer	Acceptable answers	Mark
(i)	Correct responses can be seen in (i) or (ii) An explanation linking • <u>electrons</u> (1) and <u>one</u> of • removed by friction (1) • (transferred) <u>to</u> plastic (1)	["positive electrons/ protons moving", seen anywhere in part (i) or (ii) loses this mark] ignore reference to charge before rubbing transferred from cloth	**(2)**
(ii)	opposite to charge on plastic (1) <u>equal</u> to charge on the plastic (1)	charge on cloth is positive <u>same size</u> as charge on plastic electrons transferred from the cloth equal to electrons lost by cloth	**(2)**

Q17.

Question Number:	Answer	Additional Guidance	Mark
(i)	an explanation to link **3** of the following: friction (between cloth and comb) (1) transfer of electrons / charge {from plastic comb / on to the cloth} (1) electrons carry a negative charge (1) leaving **excess** positive charge on the comb (1)	reference to positive electrons or positive charge moving loses that mark point electrons/charges are rubbed off comb (on to cloth) leaving cloth with negative charge more protons than electrons (on the comb)	**(3)** AO 2 1

Question Number:	Answer	Additional Guidance	Mark
(ii)	an explanation linking: a negative charge is induced (1) on the part of the paper closest to the comb (1) opposite charges attract (1)	 allow a clear description of induction ignore references to positive charge being moved in this context only force of attraction sufficient to pick up the pieces of paper	**(3)** AO 2 1

Q18.

Question number	Answer	Additional guidance	Mark
(i)	An explanation that combines identification - understanding (1 mark) and reasoning - understanding (1 mark): charges move (1) because of **friction** (1)	 (negative) electrons transfer glass loses electrons	**(2)**

Question number	Answer	Mark
(ii)	An explanation that combines identification - understanding (1 mark) and reasoning - understanding (1 mark): (negative) electrons are rubbed off the glass (on to the silk) (1) giving the silk a negative charge (1)	**(2)**

Q19.

Question Number	Answer	Mark
	A  **The only correct answer is A** ***B*** *is not correct because the arrows are in the wrong direction* ***C*** *is not correct because the field is not circular* ***D*** *is not correct because the field is not circular*	**(1)** AO 1 1

Q20.

Question number	Answer	Mark
	The earth wire discharges the aircraft to prevent sparking which could ignite the fuel/cause a fire	**(1)**

Q21.

Question Number	Answer	Acceptable answers	Mark
(a)(i)	**A** - negative charge has moved from the cloth to the rod		**(1)**

Question Number	Answer	Acceptable answers	Mark
(a)(ii)	An explanation linking they repelled (1) (strips had) like charge (1)	 push away same (type of) charge	**(2)**

Question Number	Answer	Acceptable answers	Mark
(b)(i)	An explanation linking any **two** from charges are separated (1) possibility of a spark (1) ignite the fuel (1)	ignore ref to electric shock pd between plane and ground cause fire / explosion	**(2)**

Question Number	Answer	Acceptable answers	Mark
(b)(ii)	An explanation linking **three** from Metals are (good) conductors (1) Electrons/(negative) charge can flow through wire (1) charge goes from/to the ground / earth (1) discharge the tank/aircraft/pipes (1)	Reject flow of positive charge for this mark plane is earthed/grounded charge does not build up/dissipates Allow no pd between plane and ground so no spark possible for 2 marks	**(3)**

(Total for Question = 8 marks)

Q22.

Question number	Answer	Additional guidance	Mark
(i)	An answer that combines the following points of understanding to provide a logical description: the situation which caused the charge separation (1) where the spark travelled {from/to} (1)	examples: when refuelling, spark between end of {fuel/pipe} and vehicle =2 spark {between/from /to} person comb/clothes/metal handle and, when combing hair/removing clothing/opening door = 2 lightning flash, between cloud and cloud/plane/ground, =2 ignore between plug and socket/jump leads	**(2)**

Question number	Answer	Additional guidance	Mark
(ii)	unit conversion (1) 0.22 μC = 0.22×10^{-6} C and 2 ms = 2×10^{-3} s substitution (1) 0.22×10^{-6} = current x 2×10^{-3} s rearrangement (1) current = $0.22 \times 10^{-6} / 2 \times 10^{-3}$ evaluation (1) 1.1×10^{-4} (A)	substitution and re-arrangement in either order both needed award full marks for correct answer without working power of ten error only loses one mark, if the rest is correct	(4)

Q23.

Question Number	Answer	Mark
(i)	**The only correct answer is A**: It removes electrons from the paint drops **B is incorrect** because that would give an overall negative charge to the drops **C is incorrect** because protons are not transferred **D is incorrect** because protons are not transferred	(1)

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation linking like charged drops are repelling each other (1) (so) spray is wider (from sprayer Y) (1)	 more spread out / finer / larger area / more dispersed	(2)

Question Number	Answer	Additional Guidance	Mark
(iii)	An explanation linking metal (wire) can conduct electrons / charge (from earth) (1) (so) prevent (positive) charge accumulating on object (1)	 metal is a conductor discharge (the object)	**(2)**