Electric Charge

Mark Scheme

Level	IGCSE(9-1)
Subject	Physics
Exam Board	Edexcel IGCSE
Module	Single Award (Paper 2P)
Topic	Electricity
Sub-Topic	Electric Charge
Booklet	Mark Scheme

Time Allowed: **62 minutes**

Score: **/51**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	775%	70%	60%	55%	50%	<50%

Question number	Answer	Notes	Marks
1 (a)	idea of transfer of <u>electrons</u>; due to friction (between floor and shoes/wheels);	reject if positive electrons seen allow 'rubbing' for friction 'electrons are rubbed off' only scores 1 mark.	2
(b) (i)	charge = current × time;	words or correct symbols e.g. Q = I × t	1
(ii)	substitution and rearrangement; evaluation; unit; e.g. (I =) 0.0017 ÷ 0.075 (I =) 0.023 A	-1 for POT error A or mA mark independently 0.02, 0.0227 etc. condone 0.022, 0.0226 etc. 23 mA gets 3 marks	3

(c)	any three of: MP1. metal button is a conductor (to earth); MP2. idea of there being a voltage / p.d. between man and button/earth; MP3. idea of {discharge / movement / flow / transfer} of electrons; MP4. <u>current</u> in man's body;	 allow 'metal conducts electricity' allow charge for electrons condone transfer of positive charge award 1 mark for idea that shock was from static electricity if no other mark awarded	3

Total 9 marks

Question number	Answer	Notes	Marks
2 (a)	Any ONE simple effect, e.g. attract scraps of paper / deflect water stream / deflect (gold leaf) electroscope/use a coulomb-meter	Ignore theoretical approaches e.g. use a charged "object" Allow any practical suggestion e.g. attracts hair/balloon	1
(b)	(charges) are transferred / lost; <u>electrons</u>;	Allow move or jump Allow • "negative electrons" • e- reject for 1 mark "positive electrons"	2
(c)	MP1. Charge rods (of different plastics); MP2. Method to allow to swing freely (suspend / watch glasses); MP3. Observation of attraction <u>and</u> repulsion;	Points may be shown on a labelled diagram Methods that would not distinguish charge (e.g. picking up paper scraps, bending a water stream) can score ONLY MP1 Allow rubbing with the cloth as charging by friction Accept alternative method e.g. induction Allow method describing deflections of a charged gold leaf electroscope (GLE) for up to 3 marks MP1 (GLE) Charge rods; MP2 (GLE) Use of (charged) GLE; MP3 (GLE) Looking for rise <u>and</u> fall of leaves;	3

(Total for Question 2 = 6 marks)

Question number	Answer	Notes	Marks
3 (a)	electrons move; from balloon to cloth;	Allow negative charges for electrons Ignore all references to • positive electrons • explanations in terms of movement of positive charge	2
(b)	Idea that movement is due to attraction; between negative charges in the hair and (positive) balloon (however expressed);	Allow unlike charges attract	2
(c)	The balloon is an insulator;	Allow poor conductor	1
(d)	A sensible suggestion including movement of electrons; e.g. electrons move from air/water/hair onto balloon charges move from the hair into the air water is a conductor so electrons move (into air/from balloon)	Allow • 'charge(s)' for electrons • the charge on the balloon is neutralised Ignore all references to 'positive charge'	1

(Total for Question 3= 6 marks)

Question number	Answer	Notes	Marks
4 (a) (i)	MP1. (due to) friction (between car and ground/air); MP2. idea of <u>electron</u> transfer;	allow idea of materials rubbing allow 'scraped off' for transfer ignore "charge", "static" reject (for MP2 mark) protons moving / positive electrons	2
(ii)	idea of an insulator OR insulating material (between car and ground);	e.g. rubber tyre allow RA e.g. 'tyre is a non-conductor' ignore comments relating to charge being unable to move e.g. 'car not earthed'	1
(b) (i)	(otherwise there would be a risk of) shock / spark / fire / explosion;	ignore "to avoid travel sickness"	1
(ii)	any 2 from: MP1. metal (strap) is a conductor; MP2. (hence) idea of current / charge moving (in the strap/metal/wire); MP3. (electrons flow) between earth/ground/road and car;	 reject references to positive charge/protons allow ideas of "earthing" or "grounding" e.g. "It (charge/car) is earthed by the strap"	2

Total 6 marks

Question number	Answer	Notes	Marks
5 (a)	MP1 Due to friction; MP2 Idea of <u>electron</u> transfer;	Allow idea of materials rubbing Ignore “charge” “static” Reject (for MP2 mark) idea of protons moving	2
(b) (i)	Idea of spark / ignition / fire / explosion	Ignore reference to shock and petrol fumes	1
(ii)	Idea of current (in the wire); OR Idea of charge moving (in the wire); Idea that this discharges tanker; OR No voltage/ p.d. remains;	ignore references to positive charges Allow: No charge is left No overall charge Charge is removed Tanker becomes neutral Ignore: “Electricity” further discussion of danger	2

Total 5 marks

Question number	Answer	Notes	Marks
6 (a)	electrons; negative;		2
(b) (i)	(droplets) repel each other / repulsive force / like charges repel; (droplets) spread out / finer spray;	Ignore: attraction of paint to object Ignore: references to paint sticking	2
(ii)	Any two from (object) attracts droplets /paint OR opposite charges attract; paint reaches back of object / obscured places (at same time); less paint wasted;	Ignore: references to paint sticking	2
(c)	risk of spark / shock /damage; related risk reduction; e.g. earth connection, appropriate use of insulation	Accept: lightning, fire, explosion, Reject: risks from current electricity risk reduction method needs to apply to stated risk Accept: earthed, earthing, grounding, rubber gloves Reject: “rubber earth strip (under cars)”	2

Question number			Answer	Accept	Reject	Marks
7	(a)	(i)	(Signal has) two values; Only;	On or off, 0 or 1, two signal strengths Binary		2
		(ii)	Any two of The idea of increased frequency (of wave or modulation); The idea of regeneration (allowing more data to arrive); The idea of using increased bandwidth; The idea of using additional (signal) level; The idea of multiplexing (e.g. use more than one channel);	send more bits/sparks, send morse code more quickly, send other letters The response should be about the signal, so ignore: idea of just sending a longer message using optical fibre(s)		2
	(b)	(i)	(wave) speed = frequency x wavelength	$v = f \times \lambda$ (accept rearrangements)		1
		(ii)	Substitution; Calculation; e.g.: 820 000 x 366 = 300 120 000 or 300 000 000 or 3×10^8 (m/s)	Bald answer;; Power of ten error (for 1 mark) e.g. 300 000 m/s Alternative <u>correct</u> units (for 2 marks) e.g. 300 000 km /s		2

Question number			Answer	Accept	Reject	Marks
7	(c)		183 (m);			1
	(d)		Any three of: MP1 Electrons move OR there is a current Or negative charge moves; MP2 (Discharge) to earth OR across cloud OR to named object – tree, house, lightning conductor; MP3 Air conducts; MP4 Phenomenon e.g. thunder clap / lightning;	Sparks generate radio waves; Lightning causes (radio) interference; Correct reference to electrostatic attraction / repulsion ;		3
					Total	**11**