PEARSON EDEXCEL GCSE PHYSICS (HIGHER) · 1PH0

PHYSICS



MARK SCHEME

TOPIC 10: ELECTRICITY AND CIRCUITS (PACK 2)

SCORE	PERCENTAGE
/89	%

STEMUP

These questions belong to Pearson Edexcel, not to us.

The examination questions, mark schemes and examiner comments in this pack were written and published by Pearson Edexcel. They are past assessment materials, reproduced here so that students can revise from them.

What we do not own

STEMUP is not affiliated with Pearson Edexcel and does not own, and makes no claim to own, any of the question, mark scheme or examiner report material in this pack. Pearson Edexcel has not endorsed, approved or been involved in the production of it. Pearson Edexcel and the qualification titles used here belong to their respective owners and appear for identification only.

Where to find the originals

Pearson Edexcel publishes its past papers, mark schemes and examiner reports. Always check the current specification at qualifications.pearson.com before you revise, because content and wording can change between series.

If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

Mark Scheme

Q1.

Question Number	Answer	Mark
	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. AO1(6 marks) AO1 Earth • earth wire connected to metal case • metal case is a conductor • (when live touches case) resistance between live and earth is very low • (very) large current to earth through (low resistance) earth wire • case is kept at same potential as earth • so cannot get a shock if (earthed) person touches metal case Fuse • made of thin wire • fuse connected between live pin and wire to kettle • temperature of wire depends on current in it • when the current is (very) large, the temperature of the wire increases beyond melting point of wire • fuse (wire) breaks • disconnects mains supply to kettle • prevents damage to house wiring • (now) there is no possibility of live wire in kettle being at mains voltage	**(6)**

Mark	Descriptor
0	• No rewardable material.
1–2	• Demonstrates elements of physics understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • Presents an explanation with some structure and coherence. (AO1)
3–4	• Demonstrates physics understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • Presents an explanation that has a structure which is mostly clear, coherent and logical. (AO1)
5–6	• Demonstrates accurate and relevant physics understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • Presents an explanation that has a well-developed structure which is clear, coherent and logical. (AO1)

Summary for guidance			
Level	**Mark**	**Additional Guidance**	**General additional guidance** e.g. At each level, as well as content, the scientific coherency of what is stated will help place the answer at the top, or the bottom, of that level.
	0	No rewardable material.	
Level 1	1–2	Additional guidance isolated facts about either fuse or earth	Possible candidate responses The fuse blows when there is a fault. The earth stops you from getting shock
Level 2	3–4	Additional guidance facts about fuse and earth that are linked to provide an explanation of the operation of either the fuse or the earth. OR a well-developed explanation of the operation of fuse or earth	Possible candidate responses The earth wire is connected to the (metal) case of the kettle. The wire in fuse melts when current becomes too big. OR A large current flows through the wires in the kettle. The wire in the fuse heats up and melts. This disconnects the kettle from the mains supply.
Level 3	5–6	Additional guidance explanation of the operation of both the fuse and the earth one explanation may be more developed than the other but both fuse and earth must be explained.	Possible candidate responses A large current flows through the wires in the kettle. The wire in the fuse heats up and melts. The earth wire keeps (exposed) metal parts at earth potential and prevents shocks

Q2.

Question number	Indicative content	Mark
*	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO1 (6 marks)** • the sequence of events is voltage change, conversion to direct current, followed by current limiting • the battery is the load in the secondary circuit, not a store of energy for the primary circuit • a transformer is needed to increase (or step up) the voltage • so a diode is needed to change a.c. to d.c. • the charging current can be limited to 15 A using a fuse (or circuit breaker) • a circuit breaker may be preferable to a fuse, since a fuse would need to be replaced after use • the transformer primary coil is connected between the live and neutral in the primary circuit • the diode is connected in the secondary circuit of the transformer • the battery(which is to be charged), diode, fuse and secondary coil should be connected in series in the secondary circuit	**(6)**

Level	Mark	Descriptor
	0	No awardable content.
Level 1	1–2	• Demonstrates elements of physics understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • Presents an explanation with some structure and coherence. (AO1)
Level 2	3–4	• Demonstrates physics understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • Presents an explanation that has a structure which is mostly clear, coherent and logical. (AO1)
Level 3	5–6	• Demonstrates accurate and relevant physics understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • Presents an explanation that has a well-developed structure which is clear, coherent and logical. (AO1)

Q3.

Question number	Answer	Additional guidance	Mark
(i)	explanation linking a suitable improvement (1) with a matching reason (1)	for example place thermometer close(r) to the thermistor stirring digital thermometer thermometer measures same temperature as thermistor to get uniform temperature (for stirring) thermometer with better resolution or scale	**(2)** **AO3.3**

Question number	Answer	Additional guidance	Mark
(ii)	an explanation including: method 2 has measurements to more significant figures / more decimal places (than method 1) (1) so the calculated answer can have more s.f.'s / d.p.'s (1)	 may be shown via a calculation accept an alternative argument in terms of consistency in final calculated answer ignore restating stem of question – e.g. so more precise ignore more accurate	**(2)** **AO2.2**

Q4.

Question number	Answer	Additional guidance	Mark
	an explanation linking distance from hinge/pivot increased (1) (therefore) smaller force needed (to close door)	 P further from hinge than Q accept the greater distance gives greater moment for 2 marks	**(2)**

Q5.

Question Number	Answer	Additional guidance	Mark
(i)	recall of moment = force x distance (1) (moment of force from person =) 600 x 0.5 **and** (moment of weight of rock =) 1800 x 0.2 (1) **moment** of force from person is less than **moment** of weight of rock. (1)	may be implied in a calculation 300 (Nm) **and** 360 (Nm) independent mark accept reverse argument	**(3)**

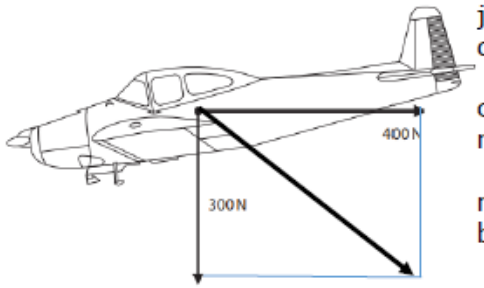
Question Number	Answer	Additional guidance	Mark
(ii)	An explanation that links increase distance between person and pivot/ reduce distance between rock and pivot / increase force from person (1) increase the moment of the force from the person / decrease the moment of the weight of the rock (1)	 use longer lever / hold lever nearer the end / move pivot nearer to rock / get someone to help to push value of new distance and calculation of new moment	(2)

Q6.

Question Number:	Answer	Additional Guidance	Mark
	an explanation linking: collisions between electrons and lattice (1) lattice {vibrates / moves} **more** (1)	throughout accept atoms / ions for lattice accept charges / charged particles for electrons allow collision between electrons in this context KE of lattice increases KE of electrons decreases	**(2)** AO 1 1

Q7.

Question Number:	Answer	Additional guidance	Mark
(i)	0.9 (k N) (1) up / upwards / ascending (1)	accept .9 or 0.90 north N ↑	**(2)** AO 3 2a AO 3 2b

Question Number:	Answer	Additional guidance	Mark
(ii)		judge length and direction by eye construction lines need not be shown magnitude need not be stated allow missing arrowhead if direction and length are correct reject answers which have any additional vectors drawn	**(1)** AO 3 2b

Question Number:	Answer	Additional Guidance	Mark
(iii)	recall and substitution (1) GPE = 750 x 10 x 1300 evaluation (1) (energy =) 9 800 000 (J)	 no POT error (could have missed out g) allow answers in standard form 9.8×10^6 allow answers that round to 9 800 000 e.g. 9 750 000 J allow 9800 kJ or 9.8MJ allow 9 555 000 J allow negative values award full marks for correct answer without working	**(2)** AO 2 1

Q8.

Question Number	Answer	Acceptable answers	Mark
(i)	force (1)	If than one word given then 0 marks.	**(1)**

Question Number	Answer	Acceptable answers	Mark
(ii)	B 0.07kg		**(1)**

Question Number	Answer	Acceptable answers	Mark
(iii)	Arrow pointing (vertically) upwards (1) Value of 1.2 (N) (written near to arrow) (1)	Marks are independent of each other	**(2)**

Q9.

Question number	Answer	Additional guidance	Mark
(i)	D R and S A, B and C are incorrect because the difference in vertical positions are all less than that shown by R and S		**(1)** **AO1**

Question number	Answer	Additional guidance	Mark
(ii)	recall (1) work done = force x distance substitution and evaluation (1) (work done =) 14,000 (J)	(work done) = 700 x 20 award full marks for the correct answer without working	**(2)** **AO1**

Question number	Answer	Additional guidance	Mark
(iii)	substitution (1) 11250 = m x 10 x 15 rearrangement and evaluation (1) (mass=) 75 (kg)	award full marks for the correct answer without working. if no other marks scored then award 1 mark for answers of 0.013 (substitution mark using h = 15)	**(2)** **AO2**

Question number	Answer	Additional guidance	Mark
(iv)	An explanation linking some work is done to overcome friction/air resistance (1) energy is dissipated /transferred to the environment (1)	allow energy is lost thermal energy	**(2)** **AO1**

Question number	Answer	Additional guidance	Mark
(v)	C increase the efficiency of the cyclist and bicycle A is incorrect because lubrication has no effect on work done against gravity B is incorrect because lubrication will increase efficiency D is incorrect because the overall energy transfer will not increase		**(1)** **AO1**

Q10.

Question number	Answer	Mark
	An answer that makes reference to: Identification – knowledge (1 mark) and reasoning / justification – knowledge (2 marks) • to begin with (there is) no current as V increases, then, after a certain voltage, the current rises • sharply / with an increasing gradient • associated with a decreasing resistance	**(3)**

Q11.

Question number	Answer	Mark
	P (ohmic) resistor/wire (1) Q (filament) lamp (1) R (semiconducting) diode (1)	**(3)**

Q12.

Question number	Answer	Mark
	An answer that combines points of interpretation/evaluation to provide a logical description: Use of lubrication / oil (1) To reduce friction (between parts) (1)	**(2)**

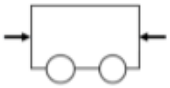
Q13.

Question number	Answer	Mark
	An explanation identifying the fact that the forces shown are acting on two different bodies / they are not acting on the same body (1)	**(1)**

Q14.

Question number	Answer	Mark
	C a javelin moves through the air after leaving an athlete's hand	**(1)**

Q15.

Question number	Answer	Mark
	B  A, C and D are incorrect because they all show a resultant force which would cause the trolley to accelerate	**(1)**

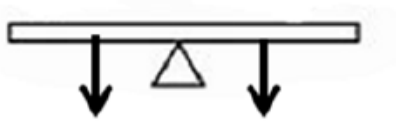
Q16.

Question Number	Answer	Mark
	The only correct answer is B: force Q **A is incorrect** because the moment of force P about the axle is zero. **C is incorrect** because moment of force R about the axle is zero. **D is incorrect** because moment of force S about the axle is zero.	**(1)**

Q17.

Question Number	Answer	Mark
	The only correct answer is D  **A is incorrect** because that is the symbol for a diode **B is incorrect** because that is the symbol for a light dependent resistor **C is incorrect** because that is a symbol for a motor	**(1)**

Q18.

Question number	Answer	Mark
	B  A, C and D are incorrect as the forces would cause the seesaw to turn	**(1)**

Q19.

Question number	Answer	Additional guidance	Mark
	Any three from: • use a higher current as the force depends on the current (1) • use more/stronger/larger range of magnets (1) • use a force meter with smaller range, e.g. 0.00 to 0.01 (1) • use a longer distance from pivot to increase the moment of the force on the wire (1)	accept voltage for current add variable resistor (in series) with power supply accept use more sensitive force meter	**(3)**

Q20.

Question number	Answer	Additional guidance	Mark
(a)	• connect ammeter in series (with thermistor) (1) • connect voltmeter in parallel (with thermistor) (1) • reverse (connections for) one of the cells (1)	allow idea that meters should be swapped for two marks (equivalent to first two points)	(3)

Question number	Answer	Additional guidance	Mark
(b)(i)	Any one of the following reasons: • the thermistor and the water are at the same temperature (1) • large volume of water gives a steady temperature rise (1)	accept idea that only small part of thermometer would be in contact with a thermistor in air accept difficult to control change in temperature of thermistor when heated in air	(1)

Question number	Answer	Additional guidance	Mark
(b)(ii)	Any one of the following developments to the procedure: • add ice to increase lower limit of temperature range (1) • use liquid with higher boiling point to increase upper limit of temperature range (1)	accept named liquid with higher boiling point, e.g. oil	(1)

Question number	Answer	Additional guidance	Mark
(c) (i)	A comparison and contrast that must include at least **one** similarity and **one** difference from the following points to a maximum of three marks: Similarities • resistance of both changes with temperature (1) • both graphs show a non-linear relationship (1) • data comparison, e.g. both have the same resistance at 80°C (1)		**(3)**
	Differences • resistance of **A** decreases with temperature but resistance of **B** increases with temperature (1) • for **A**, (largest slope/rate of change) is at lower temperature but for **B**, (largest slope/rate of change) is at higher temperature(s) (1) • for **B**, resistance is constant below 50°C but for **A** resistance is roughly constant above 60°C (1)	accept (smallest slope/rate of change) for A is at higher temperature but (smallest slope/rate of change) for B is at lower temperature	

Question number	Answer	Mark
(c) (ii)	B	**(1)**

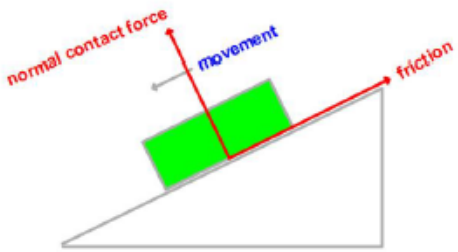
Q21.

	Answer	Acceptable answers	Mark
(a)(i)	B to the left ←		**(1)**
(a)(ii)	A accelerating		**(1)**
(a)(iii)	substitution 625x 10 (1) Evaluation 6250 (N) (1)	625 x 9.8 6125 (N) give full marks for correct answer, no working	**(2)**
(b)(i)	 (1)	upward arrow on any part of line vertical line from any point on the diagram	**(2)**

	air resistance (1)	air friction, upthrust, drag Ignore any downward arrow labelled weight or gravity	
(b)(ii)	Balanced (1) Zero (1)		**(2)**

Total for marks for question = 8

Q22.

Question number	Answer	Additional guidance	Mark
	• An arrow showing the 'normal contact force' - from between the two surfaces, acting upwards (1) • An arrow showing the 'friction' force – from between the two surfaces (1) • Both forces in the correct directions, as shown (1)  	generally upwards / away from the surface can be to the left or to the right they do not need to start from the same point	**(3)**

Q23.

Question Number:	Answer	Additional Guidance	Mark
(i)	1.5 (V)	accept $\frac{12}{8}$ or $\frac{3}{2}$ or $1\frac{1}{2}$	**(1)** AO 3 1b

Question Number:	Answer	Additional Guidance	Mark
(ii)	recall and substitution (1) $0.75 = I \times 1.5$ rearrangement (1) $(I =) \frac{0.75}{1.5} (= 0.5)$ recall, substitution and rearrangement (1) $R = \frac{1.5}{0.5}$ evaluation (1) (R =) 3.0 (Ω)	allow ecf from a(i) for all marking points substitution and rearrangement in either order allow ecf of current from MP2 for this mark point only allow other approaches such as $P = \frac{V^2}{R}$ scores 1 mark $0.75 = \frac{1.5^2}{R}$ scores 2 marks $R = \frac{(1.5)^2}{0.75}$ scores 3 marks award full marks for correct answer without working	**(4)** AO 2 1

Q24.

Question number	Answer	Additional guidance	Mark
(i)	voltmeter connected in parallel with device (1) ammeter connected in series with device (1)	voltmeter connected in parallel with battery may be in top or bottom of circuit and could be inside or outside the voltmeter connections	**(2)** **AO1**

Question number	Answer	Additional guidance	Mark
(ii)	recall and substitution (1) (power =) 12 x 4.8 evaluation (1) (power =) 58 (W)	voltmeter connected in parallel with battery allow values that round to 58 e.g. 57.6 award full marks for the correct answer without working	**(2)** **AO2**

Question number	Answer	Additional guidance	Mark
(iii)	substitution (1) (power =) 12 x 600(/1000) x 7 (x60) evaluation (1) (energy =) 3000 (J)	 allow values that round to 3000 e.g 3024 allow 1 mark for any other values of 3(.024) to any power of ten. if no other marks scored then award 1 mark for answers of 50,400 or 50.4 (substitution mark) award full marks for the correct answer without working.	**(2)** **AO2**

Q25.

Question number	Answer	Additional guidance	Mark
	an explanation linking any **three** from: lamp in second circuit is dimmer (than lamp in first circuit) (1) current in second circuit is less (than in first circuit) (1) potential difference / voltage across each lamp (in second circuit is) less / shared (1) idea that power of each lamp (in second circuit) is less / shared (1) the (total) resistance of the second circuit is more (than in first circuit) (1)	accept reverse arguments throughout	**(3)** **AO1.1**

Q26.

Question number	Answer	Mark
(i)	either power = (current)^2 × resistance OR $P = I^2 \times R$	**(1)**

Question number	Answer	Additional guidance	Mark
(ii)	substitution into $P = I^2 \times R$ (1) $55 = 4.4^2 \times R$ rearrangement (1) $R = P \div I^2$ evaluation (1) 2.8 (Ω)	Substitution and re-arrangement in either order $R = 55 \div 4.4^2$ for 2 marks allow answers that round to 2.8 award full marks for correct answer without working allow alternative route $V = P \div I = 55 \div 4.4$ then $R = V \div I = 12.5 \div 4.4$	**(3)**

Q27.

Question number	Answer	Additional guidance	Mark
	(sum of) the clockwise moments = (sum of) the anticlockwise moments	moment of magnet = moment of modelling clay moments are equal (size)	**(1)** **AO1**

Q28.

Question Number:	Answer	Additional Guidance	Mark
	an explanation linking:	allow alternative arguments such as if resistors had been in series, then...	**(3)** AO 3 2a AO 3 2b
	relevant calculation (1) R (between P and Q) = $\frac{6}{1.2}$ = 5Ω	I = $\frac{6}{20}$ = 0.3A V (between P and Q) = 1.2 x 10 = 12V	
	reasoning / interpretation of result (1) this is less than {a single resistor / two resistors in series}	current is more (than 0.3A) total p.d. is less than 12 V	
	conclusion (1) resistors must be connected <u>in parallel</u>		

Q29.

Question number	Answer	Mark
(i)	B <table><tr><td>1</td><td>same as P</td></tr></table> **The only correct answer is B** ***A*** *is incorrect because the number of teeth on P and R are equal* ***C*** *is incorrect because Q reverses the rotation of P and then R reverses the rotation of Q* ***D*** *is incorrect because Q reverses the rotation of P and then R reverses the rotation of Q*	**(1)** AO 1 1

Question Number:	Answer	Additional Guidance	Mark
(ii)	use of distance = pitch x number of teeth (moved) (1) evaluation (1) (distance =) 20 (mm)	allow first mark if 2 x 4 (=8) or 2 x 40 (=80) seen award full marks for correct answer without working	**(2)** AO 1 1

Q30.

Question number	Answer	Mark
	B	**(1)**

Q31.

	Answer	Acceptable answers	Mark
(a)	transformer	Step-up transformer Step-down transformer	**(1)**
(b)	A suggestion to include any 2 of		**(2)**

	the following • (LED) turns on and off • as voltage/current {changes direction/from +ve to –ve/ twice each second } (1) • (LED) on for (+ve) part of cycle (1) • (LED) off for (-ve) part of cycle (1)	Flash(es) / flicker(s) (on and off) current changes every 0.25 s /4 times each second Turns on twice each second = 2 marks Only on when voltage/current is +ve gains both marks	
(c)	substitute (1) 3 = I × 12 transformation (1) I = 3 ÷ 12 evaluation (1) 0 .25 (A) Ignore any unit given by candidate	Subst. and transform. either order 1 mark only can be scored for correct substitution after incorrect transposition. Accept any number of sig. figs. that rounds to 0.25 (A) 250 mA gains 3 marks give full marks for correct answer, no working 2.5 × any other power of ten = 2 marks eg 25 (A) gains 2 marks	**(3)**

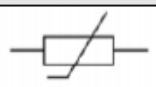
			Indicative Content	
QWC		***(d)**	A discussion including some of the following points • improved lighting levels for LEDs • energy savings per year for LEDs or calculatio time • calculation of energy savings over lifetime of L calculation of monetary savings by using LEDs • link to savings in fossil fuels for LEDs or link to LEDs and reduced global warming • comparison of lifetimes and maintenance cost	
Level	**0**	No rewardable content		
1	**1 - 2**	• a limited discussion of benefits using some pieces of the information provided, e.g. LEDs last 40 000 hours longer and the lighting levels are 200% brighter. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy		
2	**3 - 4**	• a simple discussion of benefits using some pieces of the information and processing one of them OR 2 processed pieces of information. e.g. LEDs save 3000 kW h of energy each year and are much brighter. The money they save each year compared to fluorescents is £420. OR The payback time for the LEDs is about 5 years and in that time they		

		would have to pay for the fluorescent lights to be replaced 5 times. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed discussion of benefits using processed information covering more than half of the data points in the table e.g. LEDs use less energy each year and this means that fossil fuel reserves are not used up as quickly. The LEDs save £420 each year and have a payback time of about 5 years. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Q32.

Question number	Answer	Mark
	☒ **A** acceleration This is the only vector quantity from the options given	**(1)** **AO1.1**

Q33.

Question number	Answer	Mark
	☒ **C**  Only this is the correct symbol for a thermistor	**(1)** **AO1.1**

Q34.

Question Number	Answer	Acceptable answers	Mark
(a)(i)	A suggestion linking two of: • (X-rays/they) are harmful to health (1) • airport use non-essential/ hospital use essential (1) • idea that benefits outweigh risk in hospitals (1)	Dangerous to health/damage cells/ can cause cancer/mutate cells/ionising ORA Ignore references to risks of frequent flyers	**(2)**

Question Number	Answer	Acceptable answers	Mark
(a)(ii)	A suggestion linking: lead casing / shielding (1) absorbs X-rays (1)	metal casing/shielding (security workers) out of range Ignore references to lead suits/aprons etc.	**(2)**

Question Number	Answer	Acceptable answers	Mark
(b)(i)	Explanation linking two of the following:- • cathode is heated (1) • (electrons) given enough energy (1) • (electrons) escape (from the surface) (1)	filament/wire is heated boiled off / released / emitted Ignore emission	**(2)**

Question Number	Answer	Acceptable answers	Mark
(b)(ii)	C 4.4×10^{16} (1)		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)(iii)	substitution: (1) $1.4 \times 10^{-14} = 1.6 \times 10^{-19} \times V$ Transposition (1) $(V) = 1.4 \times 10^{-14} / 1.6 \times 10^{-19}$ evaluation: (1) 88 000 (V) /88 x 10^3 (V)/ 8.8 x 10^4 (V)	substitution and transposition in any order ignore powers of 10 until evaluation 87 500(V), 9 x 10^4 (V) 88 kV, 87.5 kV, 90kV full marks for the correct numerical answer without working	**(3)**

(Total marks for question = 10 marks)