AQA GCSE Physics | 8463

SPECIFICATION POINT 4.2.3.1

Direct and alternating potential difference

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**28**
Available paper years	**2004–2025**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

4.2.3.1 Direct and alternating potential difference

Answer 01 · Mark scheme June 2004 | 3451H | Original Q11 | Legacy

The full source mark scheme begins on page 49. Follow original question 11 in that document.

Answer 02 · Mark scheme June 2004 | 3462H3 | Original Q9 | Legacy

The full source mark scheme begins on page 70. Follow original question 9 in that document.

Answer 03 · Mark scheme November 2006 | PHY1B | Original Q2 | Legacy

Two	**A**	gamma rays	**1**
	B	infra red rays	**3**
	C	radio waves	**4**
	D	ultraviolet waves	**2**

Answer 04 · Mark scheme June 2007 | PHY1B | Original Q6 | Legacy

Six	**4**	**1**	**3**	**1**

4.2.3.1 Direct and alternating potential difference

Answer 05 · Mark scheme January 2008 | PHY2H | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
(a)(i)	24(V)		1
(ii)	current always flows in the same direction **or** current only flows one way		1
(b)(i)	more power / force needed	accept energy transformed faster	1
	work done to lift the scooter uphill **or** work done against gravity	accept it moves against gravity accept energy is transformed to gravitational potential energy	1
(ii)	reduces it		1
(c)	375	**1** mark for correct substitution **1** mark for an answer = 250 **1** mark for an answer = 125	2
(d)	86400	**1** mark for correct substitution **1** mark for an answer = 43200 answer 24 gains **1** mark answer 24 Ah gains **2** marks answer 12 Ah gains **1** mark only	2
	coulomb	accept C	1
total			10

4.2.3.1 Direct and alternating potential difference

Answer 05 · Mark scheme

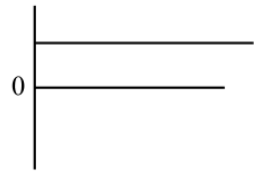
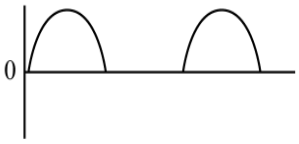
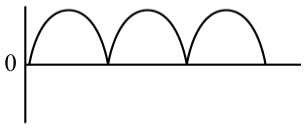
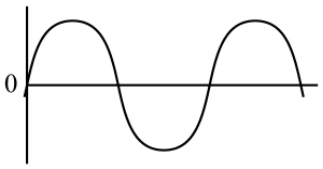
January 2008 | PHY2H | Original Q3 | Legacy

PHY2H

4.2.3.1 Direct and alternating potential difference

Answer 06 · Mark scheme January 2009 | PHY2H | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)	d.c. flows in (only) one direction		1
	a.c. changes direction (twice every cycle)	accept a.c. constantly changing direction ignore references to frequency accept answers presented as a clear diagram e.g. dc:    ac:  	1

Question 5 continues on the next page

4.2.3.1 Direct and alternating potential difference

PHY2H

Question 5 continued

5(b)(i)	10	allow **1** mark for correct transformation and substitution i.e. $\frac{2.3}{230}$ or $\frac{2300}{230}$ an answer 0.01 gains **1** mark	2
5(b)(ii)	13 A	e.c.f. accept the fuse size that is the next listed value greater than answer (b)(i)	1
Total			**5**

4.2.3.1 Direct and alternating potential difference

Answer 06 · Mark scheme January 2009 | PHY2H | Original Q5 | Legacy

PHY2H

Answer 07 · Mark scheme March 2009 | PHY1BP | Original Q4 | Legacy

Four	**2**	**3**	**2**	**3**

4.2.3.1 Direct and alternating potential difference

Answer 08 · Mark scheme June 2009 | PHY3H | Original Q1 | Legacy

Question 1

question	answers	extra information	mark
1(a)(i)	secondary(coil) / output (coil)	do **not** accept just coil	1
1(a)(ii)	core (laminated soft) iron	do **not** accept for either mark it is made out of iron ore allow **1** mark for 'it is made out of iron core'	1 1
1(a)(iii)	magnetic field (which is) changing / alternating	accept magnetism / magnetic force direction (of field) changes / strength (of field) varies scoring second mark is dependent on first mark	1 1
1(b)	...step-up .... step-down ...	both in the correct order	1
1(c)	Do not build new houses .... Build new power lines away	 deduct **1** mark for any other(s) to a minimum total of (0)	1 1
Total			**8**

4.2.3.1 Direct and alternating potential difference

Answer 08 · Mark scheme

June 2009 | PHY3H | Original Q1 | Legacy

PHY3H

4.2.3.1 Direct and alternating potential difference

Answer 09 · Mark scheme January 2010 | PHY3H | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)(i)	(laminated soft) iron	do **not** accept steel	1
5(a)(ii)	produces a magnetic field which is alternating / changing / varying and which induces / produces an alternating / changing potential difference across the secondary coil	accept magnetic flux accept current / voltage	3
5(b)	3067 (V)	allow all **3** marks for 3060 to 3070 (V) $V = \frac{230 \times 4000}{300}$ gains **2** marks $\frac{230}{V} = \frac{300}{4000}$ gains **1** mark	3
Total			**7**

4.2.3.1 Direct and alternating potential difference

Answer 09 · Mark scheme

January 2010 | PHY3H | Original Q5 | Legacy

PHY3H

4.2.3.1 Direct and alternating potential difference

Answer 10 · Mark scheme

June 2010 | PHY2H | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)	125 hertz **or** Hz	allow **1** mark for obtaining time period = 0.008 (s) **or** frequency = 1 / time period (or their calculated time period) do **not** accept hz	2 1
6(b)	50 (hertz)		1
Total			**4**

4.2.3.1 Direct and alternating potential difference

Answer 10 · Mark scheme June 2010 | PHY2H | Original Q6 | Legacy

PHY2H

Answer 11 · Mark scheme November 2010 | PHY1BP | Original Q6 | Legacy

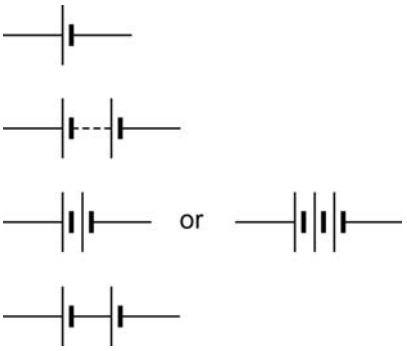
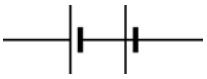
Six	**3**	**2**	**1**	**2**

4.2.3.1 Direct and alternating potential difference

Answer 12 · Mark scheme

June 2011 | PHY2H | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)(i)	ammeter and battery **in series** with the **gauge**	symbols must be correct ignore a voltmeter drawn in series	1
		accept  **not**  or cells reversed to cancel out	1
	voltmeter in parallel with the gauge	symbol must be correct accept a freestanding circuit diagram provided strain gauge is labelled or a resistor symbol used for the strain gauge	
6(a)(ii)	d.c. flows only in one direction	a.c. changes direction is insufficient	1
6(b)(i)	75	this answer only allow **1** mark for correct substitution **and** transformation, ie resistance = $\frac{3.0}{0.040}$	2

Question 6 continues on the next page

4.2.3.1 Direct and alternating potential difference

Answer 12 · Mark scheme

June 2011 | PHY2H | Original Q6 | Legacy

PHY2H

Question 6 continued

question	answers	extra information	mark
6(b)(ii)	increases		1
6(b)(iii)	elastic / strain potential	do **not** accept potential	1
Total			7

4.2.3.1 Direct and alternating potential difference

Answer 12 · Mark scheme June 2011 | PHY2H | Original Q6 | Legacy

PHY2H

4.2.3.1 Direct and alternating potential difference

Answer 13 · Mark scheme

Question 7

question	answers	extra information	mark
7(a)	400 000	allow **1** mark for correct substitution ie $\frac{25000}{?} = \frac{800}{12800}$ **or** $\frac{25}{?} = \frac{800}{12800}$	2
	volt(s) / V	an answer 400 gains **2** marks an answer 400 kilovolts / kV gains **3** marks although the unit mark is independent to gain **3** marks it must be consistent with the numerical value	1
7(b)	any **one** from: • (so that there is) no short circuit • (so that the) current goes round the coil • (so that the) current does not enter the core	do **not** accept any response in terms of heat insulation, safety or electric shock do **not** accept electricity for current	1

Question 7 continues on the next page

4.2.3.1 Direct and alternating potential difference

PHY3H

Question 7 continues

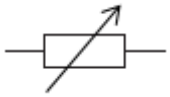
question	answers	extra information	mark
7(c)	(the alternating p.d. in the primary causes) an (alternating) current in the primary (causes an) alternating / changing (magnetic) field in the (iron) core induces (alternating) p.d. across the secondary (coil)	reference to the current in the core negates this mark accept in / through or similar for across accept current for p.d. accept output (coil) for secondary (coil) to gain **3** marks the sequence must be correct	1 1 1
Total			**7**

4.2.3.1 Direct and alternating potential difference

Answer 14 · Mark scheme

January 2013 | PH2HP | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)(i)	symbol for a diode 	accept 	1
	symbol for a variable resistor 		1
4(a)(ii)	voltmeter is in series **or** voltmeter is not in parallel		1
	ammeter is in parallel **or** ammeter is not in series	accept an answer in terms of how the circuit should be corrected voltmeter and ammeter are wrong way around is insufficient	1
4(b)(i)	0.2 (V)	accept any value between 0.20 and 0.21 inclusive	1
4(b)(ii)	37.5	allow **1** mark for I = 0.008 **or** allow **2** marks for correct substitution, ie 0.3 = 0.008 × R **or** allow **1** mark for a correct substitution using I = 0.8 **or** I = 0.08 **or** I = 0.009 **or** allow **2** marks for answers of 0.375 **or** 3.75 **or** 33(.3)	3

Question 4 continues on the next page . . .

PH2HP

Question 4 continued . . .

question	answers	extra information	mark
4(c)(i)	25	allow **1** mark for obtaining period = 0.04(s)	2
4(c)(ii)	diode has large resistance in reverse / one direction so stops current flow in that / one direction	 allow diodes only let current flow one way / direction allow **1** mark for the diode has half-rectified the (a.c. power) supply	1 1
Total			**12**

4.2.3.1 Direct and alternating potential difference

Answer 14 · Mark scheme

January 2013 | PH2HP | Original Q4 | Legacy

PH2HP

4.2.3.1 Direct and alternating potential difference

Answer 15 · Mark scheme

June 2013 | PH2HP | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)	35	an answer with more than 2 sig figs that rounds to 35 gains **2** marks allow **2** marks for correct method, ie $\frac{230}{6.5}$ allow **1** mark for I = 6.5 (A) **or** R = $\frac{230}{26}$ an answer 8.8 gains **2** marks an answer with more than 2 sig figs that rounds to 8.8 gains **1** mark	3
6(b)(i)	(maximum) current exceeds maximum safe current for a 2.5 mm^2 wire **or** (maximum) current exceeds 20 (A)	accept power exceeds maximum safe power for a 2.5 mm^2 wire (maximum) current = 26 (A) is insufficient	1
	a 2.5 mm^2 wire would overheat / melt	accept socket for wire do **not** accept plug for wire	1
6(b)(ii)	(contains) live, neutral and earth wires	accept is a three-core cable	1
	cross-sectional area of (live and neutral) wire(s) (minimum of) 4 mm^2	accept 6 mm^2 for 4 mm^2	1
	wire / cable should be insulated	accept a suitable named insulator, eg PVC / rubber / plastic	1

Question 6 continues on the next page . . .

4.2.3.1 Direct and alternating potential difference

PH2HP

Question 6 continued . . .

question	answers	extra information	mark
6(c)	a.c. is constantly changing direction	accept a.c. flows in two directions accept a.c. changes direction a.c. travels in different directions is insufficient	1
	d.c. flows in one direction only		1
Total			**10**

UMS Conversion Calculator: www.aqa.org.uk/umsconversion

4.2.3.1 Direct and alternating potential difference

Answer 16 · Mark scheme

June 2013 | PH3HP | Original Q7 | Legacy

Question 7

question	answers	extra information	mark
7(a)	(the alternating current creates) a changing / alternating magnetic field		1
	(magnetic field) in the (iron) core	accept that links with the secondary coil current in the core negates this mark	1
	(causing a) potential difference (to be) induced in / across secondary coil	accept voltage for p.d.	1
7(b)(i)	20	allow **1** mark for correct substitution, ie $\frac{230}{V_s} = \frac{575}{50}$ **or** $\frac{V_s}{230} = \frac{50}{575}$	2

Question 7 continues on the next page . . .

PH3HP

Question 7 continued . . .

question	answers	extra information	mark
7(b)(ii)	0.3 **or** correct calculation using $230 \times I_p$ = their (b)(i) × 3.45	allow **1** mark for correct substitution, ie $230 \times I_p = 20 \times 3.45$ allow ecf from (b)(i) for 20 **OR** substitution into this equation $\frac{I_p}{I_s} = \frac{N_s}{N_p}$	2
7(c)	(switch mode transformers) use (very) little power / current / energy when switched on but no load is applied **or** it is more efficient	accept no for little ignore it is more portable do **not** accept electricity for power / current / energy accept does not get as hot **or** less heat produced	1
7(d)	any **one** from: • fewer (waste) batteries have to be sent to / buried in land-fill • the soil is polluted less by batteries in land-fill • fewer (waste) batteries have to be recycled • fewer batteries have to be made • less raw materials are used in making batteries • customers have to replace their batteries less often • customers have to buy fewer (replacement) batteries	longer lifetime is insufficient it costs less is insufficient	1
Total			**9**

UMS Conversion Calculator: www.aqa.org.uk/umsconversion

4.2.3.1 Direct and alternating potential difference

Answer 17 · Mark scheme

June 2014 | PH3HP | Original Q8 | Legacy

Question	Answers	Extra information	Mark	AO spec ref
8(a)	(a) hydraulic (system)		1	AO1 3.2.3b
8(b)	15.40×10^2 **or** 1540	allow **1** mark for correct substitution, ie $8.75 \times 10^4 = \frac{F}{1.76 \times 10^{-2}}$ **or** $87\,500 = \frac{F}{0.0176}$ **or** $F = 8.75 \times 10^4 \times 1.76 \times 10^{-2}$ **or** $F = 87\,500 \times 0.0176$	2	AO2 3.2.3
8(c)	any **one** environmental **advantage**: plant oil is renewable using plant oil will conserve (limited) supplies **or** extend lifetime of the usual/crude oil. plant oil releases less carbon dioxide (when it is being produced / processed) plant oil will add less carbon dioxide to the atmosphere (when it is being produced / processed, than the usual oil) plant oil removes carbon dioxide from **or** adds oxygen to the air when it is growing	stating a converse statement is insufficient, or a disadvantage of the usual oil, ie the usual oil is non-renewable stating that plant oil is carbon neutral is insufficient	1	AO2 3.2.3c

Question 8 continues on the next page . . .

4.2.3.1 Direct and alternating potential difference

Answer 17 · Mark scheme

June 2014 | PH3HP | Original Q8 | Legacy

Question 8 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
8(d)	(the current flowing through the coil) creates a magnetic field (around the coil) (this magnetic field) interacts with the permanent magnetic field **or** current carrying conductor is in a (permanent) magnetic field this produces a (resultant) force (and coil / cone moves) when the direction of the current changes, the direction of the force changes to the opposite direction	it must be clear which magnetic field is which accept for **2** marks the magnetic field of the coil interacts with the permanent magnetic field	1 1 1 1	AO2 AO3 3.3.1a, b
Total			**8**	

4.2.3.1 Direct and alternating potential difference

Answer 18 · Mark scheme June 2015 | PH3HP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. ref.
5(a)(i)	(closing the switch makes) a current (through the wire) (the current flowing) creates a magnetic field (around the wire) this field interacts with the permanent magnetic field	 accept links / crosses attracts / repels is insufficient	1 1 1	AO1 P3.3.1a, b
5(a)(ii)	arrow drawn showing upwards force on XY	judge vertical by eye the arrow must be on or close to the wire XY	1	AO2 P3.3.1e
5(a)(iii)	motor	accept catapult	1	AO1 P3.3.1b
5(b)(i)	the wire moves up and down or the wire vibrates	 back and forth or side to side is insufficient for vibrate	1	AO2 P3.3.1e
5(b)(ii)	the force (continually) changes direction (from upwards to downwards, on the wire)	accept the direction of the magnetic field (of the wire) changes	1	AO1 P3.3.1e
Total			7	

4.2.3.1 Direct and alternating potential difference

Answer 18 · Mark scheme

June 2015 | PH3HP | Original Q5 | Legacy



4.2.3.1 Direct and alternating potential difference

Answer 19 · Mark scheme June 2015 | PH3HP | Original Q8 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. ref.
8(a)	an alternating current through the primary coil (in the charging base)	it must be clear which coil is being referred to	1	AO1 P3.3.2d
	causes a changing / alternating magnetic field in / around the (iron) bar		1	
	which induces an (alternating) p.d. across the secondary coil (in the toothbrush)	accept induces an (alternating) current in the secondary coil	1	
8(b)	18	allow **1** mark for correct substitution, ie $\frac{230}{7.2} = \frac{575}{n_s}$	2	AO2 P3.3.2g
Total			5	

4.2.3.1 Direct and alternating potential difference

Answer 20 · Mark scheme

June 2016 | PH3HP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	a magnetic field that is alternating / changing	accept electromagnetic field heat is insufficient	1 1	AO1 3.3.2d
2(b)	20	allow **1** mark for correct substitution, ie $\frac{230}{11.5}$ provided no subsequent step	2	AO2 3.3.2g
2(c)	(most) transformers are not 100% efficient	allow energy / power is lost to the surroundings allow energy / power is lost as heat / sound power is lost is insufficient	1	AO1 3.3.2h
2(d)(i)	0.01 (V) because there is a change in p.d. each time (the number of turns changes)	 allow because all the results (to 2 decimal places) are different accept if results were to 1 decimal place, there might not be a difference	1 1	AO3 3.3.2a 3.3.2b
2(d)(ii)	student 2 moved the coil more slowly (than student 1)	accept student 2 moved the coil at a different speed to student 1 do not accept student 2 moved the coil faster (than student 1)	1	AO3 3.3.2a 3.3.2b
2(d)(iii)	both sets of results show the same pattern	accept trend for pattern results are similar is insufficient results follow a pattern is insufficient	1	AO3 3.3.2a 3.3.2b

Question 2 continues on the next page . . .

4.2.3.1 Direct and alternating potential difference

Answer 20 · Mark scheme

June 2016 | PH3HP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(d)(iv)	(electromagnetic) induction	accept it is induced do not accept electric / magnetic induction	1	AO1 3.3.2a
2(e)	any **one** from: • more economical / cheaper for the consumer • easier/cheaper to replace if broken/lost • since fewer transformers need to be made less resources are used	allow more convenient allow in case one gets lost allow fewer plug sockets are needed allow fewer transformers are needed environmentally friendly is insufficient	1	AO3 3.3.2
Total			11	

4.2.3.1 Direct and alternating potential difference

Answer 20 · Mark scheme

June 2016 | PH3HP | Original Q2 | Legacy



4.2.3.1 Direct and alternating potential difference

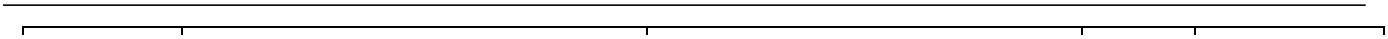
Answer 21 · Mark scheme June 2017 | PH3HP | Original Q1 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)	any **two** from: • The number of turns on the coil • The strength of the magnet • The (stiffness of the) elastic bands	do not accept number of coils allow how tightly the turns are wrapped allow distance between the magnet and coil / cone allow strength/elasticity/tension for stiffness ignore references to size of paper cone change direction of current or magnet is insufficient	2	AO3 3.3.1c
1(b)(i)	1.3 (cm)	two values (1.4 and 2.7) correctly taken from the graph scores **1** mark	2	AO2 3.3.1b
1(b)(ii)	any **two** from: • (Below 1A) as the current increases the distance increases • Above 1A the distance does not change (with current) • Between 0.3A and 0.7A the relationship is linear	accept the maximum distance (that the cone can move) is 2.8 cm accept between 0.6 cm and 2.2 cm the relationship is linear ignore references to positive correlation and direct proportionality a description of the shape of the graph is insufficient eg the line levels off after 1A	2	AO3 3.3.1c
Total			**6**	

4.2.3.1 Direct and alternating potential difference

Answer 21 · Mark scheme

June 2017 | PH3HP | Original Q1 | Legacy



4.2.3.1 Direct and alternating potential difference

Answer 22 · Mark scheme

June 2018 | 8463/2H | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	P-waves are longitudinal and S-waves are transverse		1	AO1 4.6.1.5
03.2	0.4		1	AO2 4.6.1.2
03.3	wave speed = frequency × wavelength	allow v = f λ	1	AO1 4.6.1.2
03.4	7200 = 0.4 × wavelength wavelength = $\frac{7200}{0.4}$ wavelength = 18 000 (m)	an answer 18 000 scores **3** marks allow up to full marks for ecf using their answer to question **03.2** a method shown as 7200 × 2.5 = 18 000 scores **0** marks	1 1 1	AO2 4.6.1.2
03.5	because S-waves cannot travel through a liquid and S-waves do not travel through the (outer) core	allow some (seismic) waves cannot travel through a liquid and do not go through the core for **1** mark	1 1	AO1 4.6.1.5
03.6	magnetic field around the coil changes **or** the magnetic field (lines) cut by the coil	allow the generator effect	1	4.7.3.1 AO2

4.2.3.1 Direct and alternating potential difference

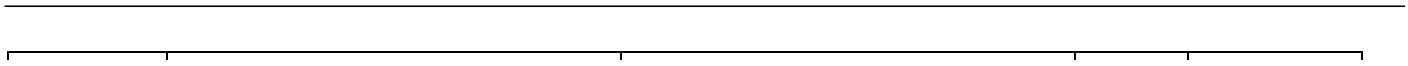
Answer 22 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	because the magnet changes direction		1	4.7.3.1 AO2
03.8	stationary		1	4.7.3.1 AO2
03.9	any **two** from: • stronger magnetic field • more turns on the coil • turns pushed closer together • spring with a lower spring constant	 allow stronger magnet allow heavier magnet bigger magnet is insufficient bigger coil is insufficient do **not** accept more coils of wire allow less stiff spring allow weaker spring do **not** accept add an iron core	2	4.7.3.1 AO2
Total			**13**	

4.2.3.1 Direct and alternating potential difference

Answer 22 · Mark scheme

June 2018 | 8463/2H | Original Q3



4.2.3.1 Direct and alternating potential difference

Answer 23 · Mark scheme

November 2020 | 8463/2H | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	to vary the (output) potential difference so that you don't need a different generator for each type of device	allow different devices require different potential differences allow so that it is compatible with different devices do **not** allow answers in terms of power	1 1	AO3 4.7.3.4
07.2	$\frac{1.5}{5.0} = \frac{150}{N_s}$ $N_s = \frac{150}{0.3}$ $N_s = 500$		1 1 1	AO2 4.7.3.4
07.3	the coil moves through the magnetic field **or** the coil cuts magnetic field lines a potential difference is <u>induced</u> (across the coil) there is a complete circuit, so a current is induced (in the coil) every half turn the potential difference reverses direction so (every half turn) the current changes direction		1 1 1 1 1	AO1 4.7.3.1 4.7.3.2
07.4	provides a continuous / moveable contact / connection (between the coil and the transformer / contacts / brushes) **or** stops the wires from twisting together		1	AO3 4.7.3.2

4.2.3.1 Direct and alternating potential difference

Answer 23 · Mark scheme

07.5	(after disconnection) there is no induced current so no magnetic field (produced around / by the coil) to oppose the movement of the coil		1 1 1	AO1 4.7.3.1
Total			**14**	

4.2.3.1 Direct and alternating potential difference

Answer 24 · Mark scheme

November 2021 | 8463/1H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	the polarity (of the supply) does not change	allow potential difference in one direction (only)	1	AO1 4.2.3.1
01.2	energy transferred = power × time		1	AO1 4.1.1.4 4.2.4.2
01.3	162 000 000 = 7200 × t $t = \frac{162\,000\,000}{7200}$ t = 22 500 (s)		1 1 1	AO2 4.1.1.4 4.2.4.2
01.4	$V = I \times R$		1	AO1 4.2.1.3
01.5	480 = 15 × R $R = \frac{480}{15}$ R = 32 (Ω)		1 1 1	AO2 4.2.1.3
01.6	time taken using system **A** is double the time of system **B**		1	AO3 4.2.4.1
Total			**10**	

4.2.3.1 Direct and alternating potential difference

Answer 25 · Mark scheme

June 2022 | 8463/2HR | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	**A** primary coil **and** **B** secondary coil		1	AO1 4.7.3.4
	C iron core		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	$\frac{230}{V_s} = \frac{200}{1200}$		1	AO2 4.7.3.4
	$V_s = \frac{1200 \times 230}{200}$		1	
	$V_s = 1380$ (V)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	(the alternating current causes) a changing magnetic field around the primary (coil)		1	AO2 4.7.3.4
	creates magnetic field that changes direction in the core	allow creates a changing magnetic field in the core	1	
	this induces an alternating potential difference across the secondary (coil causing an alternating current)		1	

4.2.3.1 Direct and alternating potential difference

Answer 25 · Mark scheme

June 2022 | 8463/2HR | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	down		1	AO2 4.7.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	$B = 60 \times 10^{-6}$ (T)		1	AO2 4.7.2.2
	$0.045 = 60 \times 10^{-6} \times 50 \times l$	allow correct substitution of incorrectly / not converted value of B	1	
	$l = \dfrac{0.045}{60 \times 10^{-6} \times 50}$	allow correct rearrangement using an incorrectly / not converted value of B	1	
	$l = 15$ (m)	allow a correct calculation using an incorrectly / not converted value of B	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.6	the wire / force is at right angles to the magnetic field	allow the current is constant allow the cable is straight allow the field is uniform allow the force is constant	1	AO3 4.7.2.2

Total Question 7		**14**

4.2.3.1 Direct and alternating potential difference

Answer 26 · Mark scheme

June 2023 | 8463/1H | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	polarity of the potential difference doesn't change	allow direction of the potential difference doesn't change	1	AO1 4.2.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	$E = QV$		1	AO1 4.2.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	$5010 = Q \times 12$ $Q = \frac{5010}{12}$ $Q = 417.5$ (C)	 allow 418 (C)	1 1 1	AO2 4.2.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	$5010 = 0.015 \times L$ $L = \frac{5010}{0.015}$ $L = 334\,000$ (J/kg)		1 1 1	AO2 4.3.2.3

4.2.3.1 Direct and alternating potential difference

Answer 26 · Mark scheme

June 2023 | 8463/1H | Original Q3

Question	Answers	Mark	AO / Spec. Ref.
03.5	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO1 4.3.1.1 4.3.2.1
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content • particles in a solid are in a regular pattern • particles in a liquid are in a random arrangement • particles in a solid are vibrating about fixed positions • particles in a liquid are moving freely • as the ice changes to water the temperature remains constant • because as the ice changes to water the potential energy of the particles increases • as the water warms the particles move faster • so the kinetic energy of the particles increases • internal energy is the total kinetic and potential energy of all the particles ignore any references to density of ice vs liquid water ignore any references to spacing of particles		

Total Question 3	14

4.2.3.1 Direct and alternating potential difference

Answer 27 · Mark scheme

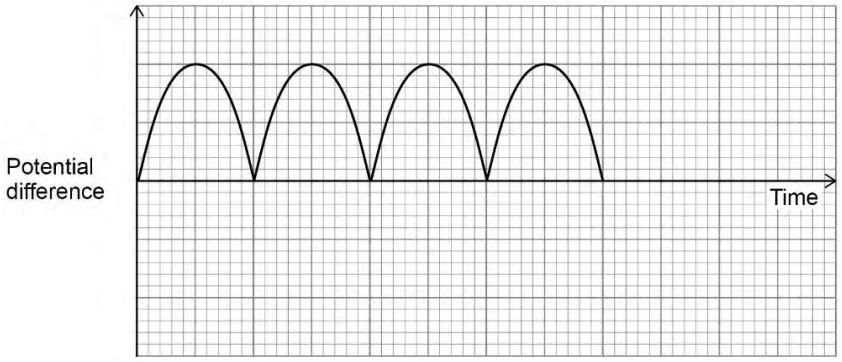
June 2023 | 8463/2H | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	the coil moves through the (magnetic) field **or** the coil cuts (magnetic) field lines		1	AO1 4.7.1.2 4.7.3.1 4.7.3.2
	a potential difference is induced (across the coil)		1	
	there is a complete circuit, so a current is induced (in the coil)		1	
	(because) each half-revolution, the two ends of the coil swap from one brush to the other **or** each half-revolution, (the two halves of) the commutator switch brushes / contacts	(because) the half of the coil connected to each brush always moves in the same direction	1	
	(so) the direction of the (induced) current / potential difference does not reverse every half rotation	allow the direction of the (induced) current / potential difference is the same every half rotation	1	

4.2.3.1 Direct and alternating potential difference

Answer 27 · Mark scheme June 2023 | 8463/2H | Original Q9

Question	Answers	Mark	AO / Spec. Ref.
09.2	 allow a correct graph showing a negative output potential difference only	1	AO1 4.7.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	(after disconnection) there is no (induced) current		1	AO1 4.7.3.1
	(so) no magnetic field (produced around / by the coil)		1	
	to oppose the movement of the coil	allow no force opposes the movement of the coil	1	

Total Question 9	**9**

4.2.3.1 Direct and alternating potential difference

Answer 28 · Mark scheme

June 2025 | 8463/2H | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	iron is easily magnetised (and demagnetised)	ignore magnetic unqualified allow it is magnetically soft do **not** accept iron is a conductor	1	AO1 4.7.3.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	$V_s = 400\,000$ V $\frac{V_p}{400\,000} = \frac{345}{6000}$ $V_p = 0.0575 \times 400\,000$ 23 000 (V)	subsequent marks may be awarded if an incorrectly / not converted *V*s is used	1 1 1 1	AO2 4.7.3.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	(the ac in the primary) causes a changing magnetic field in the core the secondary coil cuts through the (changing) magnetic field inducing a pd (across the ends of the secondary coil) **or** so a pd is induced (across the ends of the secondary coil)		1 1 1	AO1 4.7.3.4

Total Question 9	8

GCSE 2004
June Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Physics Specification B
3451/F

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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4.2.3.1 Direct and alternating potential difference

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4.2.3.1 Direct and alternating potential difference

GCSE PHYSICS

INFORMATION FOR EXAMINERS

1. General

The mark scheme for each question shows:

- the marks available for each part of the question;
- the total marks available for the question;
- the typical answer or answers which are expected;
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:
where consequential marking needs to be considered in a calculation;
or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; e.g. allow smooth / free movement.)

3. Marking points

3.1 Marking of Quality of Written Communication

Where *Quality of written communication* appears in the mark scheme, one mark is to be awarded for either of the following points:

- Using correct scientific terms
- Correct sequencing or linking of ideas or points

The mark scheme will specify which of the points is to be awarded in a particular question. A QoWC mark can be awarded for a scientific answer, even if it is not accurate. It cannot be awarded for a nonsensical or non-scientific answer.
On the script, the QoWC tick should be identified by a 'q' written next to it.

3.2 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

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Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.3 Use of chemical symbols/formulae

If a candidate writes a chemical symbol/formula instead of a required chemical name, full credit can be given if the symbol/formula is correct and if, in the context of the question, such action is appropriate.

3.4 The marking of quantitative relationships

Full credit can be given for a correct quantitative relationship expressed in:

- named units;
- physical quantities;
- standard symbols;
- a combination of physical quantities and units.

No credit can be given for any quantitative relationship expressed in terms of:

- a combination of physical quantities, units and symbols;
- a diagram, e.g. the ohm's law triangle, unless the rest of the answer shows clearly that the candidate understands the relationships involved.

3.5 Marking procedure for calculations

3.5.1 Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.
However:

- if the answer is incorrect, mark(s) can be gained by correct substitution/working and this is shown in the 'extra information' column;
- if the answer is correct, but an incorrect relationship is written in the working, then no marks can be awarded (see 3.5.2).

3.5.2 Where calculations are based on incorrectly recalled relationships, neither the incorrectly recalled relationship, nor the resulting calculation based on the incorrect relationship, will be credited.

3.6 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

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3.7 Errors carried forward

There should be no error carried forward from a previous answer which has been based on wrong science. Any error in the answers to a structured question should be penalised once only.

Examples

(a) A candidate who calculates average speed using speed = time/distance **and** then proceeds to use this incorrect answer to calculate an acceleration based on the correct quantitative relationship should be given credit for the use of the correct acceleration relationship but none for either numerical answer.

(b) A candidate who incorrectly calculates average speed using speed = distance/time and then proceeds to use this incorrect value to calculate an acceleration based on the correct quantitative relationship, should be given credit for the use of both correct quantitative relationships **and** for the correct substitution and use of the incorrect value in the calculation of the rate of acceleration.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.8 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.9 Brackets

(…..) is used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.10 Interpretation of marginal points

There will be times when the answer is almost, but not quite, correct. Some examiners would award a mark while others would not. In any one script, an attempt should be made to balance these nearly correct answers by giving the mark on some occasions but not on others. If this is not done, the marking would end up being too lenient or too harsh.

3.11 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

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4.2.3.1 Direct and alternating potential difference

GCSE Physics
Foundation Tier 3451/F

3451F Q1

question	answers	extra information	mark
(a)	comet	correct order only	1
	elliptical		1
	Milky Way		1
	Universe		1
(b)(i)	D A C B	allow **2** marks for two letters in the correct place allow **1** mark for one letter in the correct place	3
(ii)	A		1
total			8

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4.2.3.1 Direct and alternating potential difference

3451F Q2

question	answers	extra information	mark
(a)	95		1
(b)	alpha	accept correct symbol	1
(c)	any **two** from: • radiation is outside the body • radiation will not reach (living) cells • radiation absorbed by the air	 accept detector is on ceiling or high up the wall accept radiation cannot pass through the body / skin accept cannot pass through the plastic casing do **not** accept because it is alpha radiation – unless qualified do **not** accept does not give off harmful substance do **not** accept cannot pass through building materials etc.	2
(d)	less (than)		1
total			5

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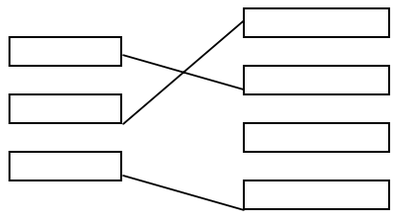
4.2.3.1 Direct and alternating potential difference

3451F Q3

question	answers	extra information	mark
(a)	generator	accept dynamo accept alternator	1
(b)(i)	1400	ignore units	1
(ii)	0.3 or 30%	any incorrect unit penalise **1** mark allow **1** mark for the correct use of 600 **or** 0.3% **or** 30	2
(c)	**1** mark for each correct link 	if more than 3 lines are drawn, mark only 3 lines starting with those that are incorrect	3
(d)(i)	110	no tolerance	1
(ii)	12	no tolerance	1
(iii)	wind speed may be too low to operate the generator	accept wind may not always blow accept power depends on wind speed accept does not generate if wind speed is too high accept does not generate if wind speed is above 12 (m/s) accept does not generate if wind speed is below 1.6 (m/s) accept it is unreliable do **not** accept answers referring to cost only	1
total			10

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4.2.3.1 Direct and alternating potential difference

3451F Q4

question	answers	extra information	mark
(a)	B E A D	allow **1** mark for each letter in the correct place, to a maximum of **3** marks	3
(b)	(a spark) may cause the (petrol vapour) to explode / ignite	accept petrol for (petrol vapour) accept catch fire for explode	1
	connect tanker to earth with a (conducting) wire / chain **or** earth the tanker	accept ground for earth	1
(c)	**Quality of written communication**	for a logical sequence	1
	any **two** from:		2
	• when current greater than fuse rating / value	accept when current too great for appliance do **not** accept 'if there is too much current' do **not** accept voltage or electricity	
	• fuse (becomes hot and) melts / burns out	accept fuse blows / breaks	
	• circuit is broken	accept circuit switched off this cannot score credit on its own	
total			8

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4.2.3.1 Direct and alternating potential difference

3451F Q5

question	answers	extra information	mark
(a)(i)	crust		1
(ii)	inner core is <u>solid</u> outer core is liquid	do **not** accept just rock inner core is denser / hotter than outer core gets **2** marks accept one is solid and one is liquid for **1** mark accept they are different densities for **1** mark wrong way round = **0** marks	1 1
(b)	seismograph		1
(c)	difficult to measure (slow) movement (1) of plates (1) dependent mark **or** difficult to measure friction / forces (1) between plates (1) dependent mark		1 1
(d)	geothermal		1
(e)(i)	5000		1
(ii)	2500		1
total			9

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4.2.3.1 Direct and alternating potential difference

3451F Q6

	answers	extra information	mark
(a)	converging image object image object shorter		1 1 1 1 1 1
(b)(i)	(Earth's) gravity	accept centripetal accept minor misspellings, however, do **not** credit any response which could be 'centrifugal'	1
(ii)	to(wards) (the centre of the) Earth	allow inwards do **not** accept downwards	1
(c)(i)	**either** friction (force) **or** centripetal force between the tyres / wheels and (the surface of) the road	 allow grip allow on the tyres / wheels **or** towards the centre of the bend / arc / circle	 1 1
(ii)	mass **or** speed **or** momentum radius / diameter	allow weight allow velocity do **not** credit 'curvature' or 'circumference'	1 1
(d)	centripetal	accept minor misspellings (see above)	1
total			13

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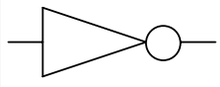
4.2.3.1 Direct and alternating potential difference

3451F Q7

	answers	extra information	mark
(a)(i)	two switches in series **and** circuit complete	ignore small imperfections	1
(ii)	two switches in parallel **and** circuit complete	ignore small imperfections	1
(iii)	one switch in parallel with the cell / lamp (but **not** both)	ignore small imperfections	1
(iv)	(i) AND (ii) OR (iii) NOT	accept 'and' accept 'or' accept 'not'	1 1 1
(b)(i)	when it is light the sensor sends on / high / 1 signal to the gate off / low / 0 sent to the lamp **or** when it is dark the sensor sends off / low / 0 signal to the gate (1) on / high / 1 sent to the lamp (1)		1 1
(ii)	any suitable application	e.g. to switch a security light on (and off) e.g. to switch a light on when it is dark do **not** credit just '… to switch a light on / off'	1
(c)(i)		accept shading-in of either or both parts end connections are not required accept any orientation	1
(ii)	1 0 **or** 0 1 0 1 1 0	all correct	1
(iii)	truth (table)		1
total			12

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4.2.3.1 Direct and alternating potential difference

3451F Q8

question	answers	extra information	mark
(a)	60		1
(b)	$5\frac{1}{2}$ hours	must include unit	1
(c)	30		1
(d)	30 minutes or $\frac{1}{2}$ hour	must include unit	1
(e)	D **and** E least steep part of the graph	accept finish for E accept correct numbers from axes with units accept covers smallest distance in a set time accept only moves 5 km in $1\frac{1}{2}$ hours (accept anything between 5 and 6) ignore horse is tired	1 1
total			6

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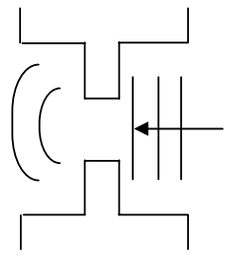
4.2.3.1 Direct and alternating potential difference

3451F Q9

question	answers	extra information	mark
(a)(i)	any **one** from: • (doctors) to see inside a patients body **or** endoscope • telephone cables • optical fibre / fibre optic lamps **or** (artificial) Christmas trees • data transfer **or** internet connection	 accept keyhole surgery do **not** accept flex **or** wires for cable accept decorative / ornamental lighting accept any feasible practical suggestion for taking light to a difficult to access place do **not** accept lighting unqualified do **not** accept lamp unqualified do **not** accept communications unless clarified	1
(ii)	(incident) ray angle greater than critical angle total internal reflection occurs	either order accept (incident) ray greater than 42° accept TIR do **not** accept just description of TIR	1 1
(b)(i)	waves shown diffracting in the correct direction 	ignore wavelength	1
(ii)	diffraction	accept diffract / diffracted	1
total			5

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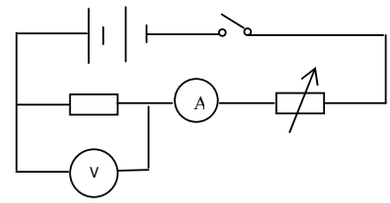
4.2.3.1 Direct and alternating potential difference

3451F Q10

question	answers	extra information	mark
(a)	all symbols correct	 accept push switch symbol switch may be open or closed any lines through symbols = **0** marks	1
	correct circuit drawn voltmeter must be across resistor only	polarity of cells not relevant provided they are joined correctly two cells are required in the diagram ignore the order of the components allow small gaps in circuit omission of any component = **0** marks	1
(b)(i)	potential difference = current × resistance	accept voltage or p.d. for potential difference accept $V = I \times R$ accept  provided subsequent use correct do **not** accept C for current	1
(ii)	2	allow **1** mark for correct substitution wrong working loses both marks	2
(iii)	straight line drawn <u>through the origin</u> straight line passes through $I = 0.4, V =$ their (b)(ii) / 2 **and** 0.0	judge by eye this mark may be awarded if all points shown including these points are correct even if no line is drawn N.B. a curve scores **0** marks	1 1 dep
(c)	temperature <u>increases</u>	accept filament lamp / it gets <u>hotter</u> allow heat for temperature	1
total			8

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4.2.3.1 Direct and alternating potential difference

3451F Q11

question	answers	extra information	mark
(a)(i)	gamma rays	accept gamma accept correct symbol	1
(ii)	infra red	accept IR	1
(b)	ultraviolet <u>absorbed</u> by ink (energy) given out as light	 accept glows / luminous accept for **both** marks the ink is fluorescent do **not** accept answers in terms of uv being reflected	1 1
(c)	any **two** from: • UV can damage / kill / ionise / alter (normal) cells • change DNA structure **or** mutate • (normal) cells may become cancerous	 do **not** accept attacks cells **or** burns skin accept may cause (skin) cancer accept abnormal cell multiplication	2
(d)(i)	microwaves **and** infra red	both answers needed in either order do **not** accept heat for IR	1
(ii)	0.9	allow **1** mark for the <u>correct</u> use of 1.8 (kW) $(1.8 \times \frac{1}{2}$ or $1.8 \times 30)$ i.e. adding the correct 2 power values	2
total			9

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4.2.3.1 Direct and alternating potential difference

3451F Q12

question	answers	extra information	mark
(a)(i)	accelerating	accept getting faster accept speed / velocity increasing	1
(ii)	acceleration <u>increases</u>	accept velocity / speed increases <u>more</u> rapidly do **not** accept velocity / speed increases	1
(b)(i)	$\text{acceleration} = \frac{\text{change in velocity}}{\text{time (taken)}}$	accept $a = \frac{v - u}{t}$ **or** $a = \frac{v_1 - v_2}{t}$ do **not** accept velocity for change in velocity do **not** accept change in speed do **not** accept $a = \frac{v}{t}$	1
(ii)	15	allow **1** mark for an answer of 900 **or** for <u>correct</u> use of 540 seconds	2
(iii)	velocity includes direction	accept velocity is a vector (quantity) accept converse answer	1
(c)	force of gravity (between <u>shuttle</u> and Earth) plus correct orbital speed (makes <u>shuttle</u> move in a curve)	accept gravitational pull if used correctly accept forward motion **or** constant speed for orbital speed accept it is travelling fast enough accept for **2** marks the force of gravity provides the <u>centripetal</u> force	1 1
(d)	black is a good emitter of radiation **or** to limit the temperature rise inside the shuttle	accept heat for radiation accept the tiles are good insulation do **not** accept black absorbs heat on its own do **not** accept tiles are heat proof	1
total			9

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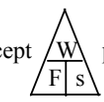
4.2.3.1 Direct and alternating potential difference

3451F Q13

question	answers	extra information	mark
(a)(i)	work (done) = force (applied) × distance (moved)	accept W = F × s or W = F × d accept  provided subsequent method is correct	1
(ii)	240 000 joules	allow **1** mark for correct substitution **or** correct use of 1200 (N) accept J do **not** accept j / Nm	2 1
(b)	800 (watts)	accept 0.8 kW accept their (a)(ii) ÷ 300 correctly evaluated for **2** marks allow **1** mark for correct substitution (a)(ii) ÷ 5 correctly evaluated for **1** mark	2
(c)(i)	any **one** from: • needs to raise the chair / lift • lifting more than one chair • energy transfer to the surroundings correctly qualified	 allow lifting more than 2 people implication of a heavier weight accept loss for transfer do **not** accept motor inefficient do **not** accept motor gets hot do **not** accept friction unless the location is specified as external to the motor	1
(ii)	electrical potential	accept electric **both** answers required for the mark	1
total			8

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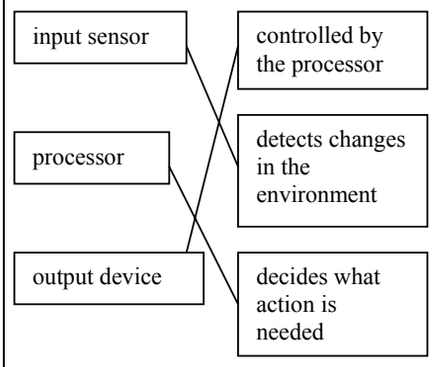
4.2.3.1 Direct and alternating potential difference

3451F Q14

	answers	extra information	mark
(a)(i)	current		1
(ii)	resistance decreases	 accept 'the flow of electrons / current (through it) increases' for **1** mark do **not** credit just '… it will get warmer'	1 1
(b)		all pairs correct one pair correct for **1** mark	2
(c)(i)	potential divider	accept voltage divider	1
(ii)	4 (volts)	$6 \times \frac{30}{45}$ for **1** mark	2
(iii)	across the new resistor…(will) increase across R_2 … (will) decrease	 N.B. independent marks	1 1
total			10

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4.2.3.1 Direct and alternating potential difference

3451F Q15

	answers	extra information	mark
(a)	relay (normally open) (switch)	each mark is independent	1
	… switch on a (larger) current (in another circuit) **or** switch on a higher voltage circuit	do **not** accept switch on another circuit **or** smaller / equal current	1
	light emitting diode / LED	do **not** credit LDR	1
	… in one / direct / certain direction **or** from left to right	**or** when the cathode is connected to the negative terminal / side **or** when the left-hand side is connected to the positive terminal / side do **not** credit just '… is big enough' do **not** accept 'positive direction'	1
	AND gate	accept 'and' gate	1
	… (both) inputs are on / high / 1 **or** current flows in both inputs	do **not** accept numerical values unless expanded	1
(b)	**Quality of written communication**	If in a sensible order which clearly indicates advantages or disadvantages, including answers in the form of a table **or** as bullet points Q ✓ Q X	1
	any **three** from: • advantage of mobile phones • drawback of mobile phones • benefit of the Internet • drawback of the Internet	 e.g. more convenient for service engineers e.g. calls can be received away from base e.g. privacy can be more easily invaded e.g. drivers can be distracted e.g. microwaves / radio waves can / may cause damage to the brain e.g. access to educational material e.g. some material is salacious e.g. spam (on external e-mail) these are examples candidates may be credited for a variety of responses	3
total			10

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4.2.3.1 Direct and alternating potential difference

3451F Q16

question	answers	extra information	mark
(a)	**Y** and **Z** they have the same number of protons **or** same atomic number	 accept they have the same number of electrons **or** same number of protons **and** electrons allow only different in number of neutrons N.B. independent marks	1 1
(b)	**Quality of written communication** A – alpha particle passes straight through the empty space of the atom **or** it is a long way from the nucleus B – alpha particle deflected / repelled / repulsed by the (positive) nucleus C – alpha particle heading straight for the nucleus is deflected / repelled / repulsed backwards	for correct use of terms underlined in B **or** C Q ✓ Q X describes 3 tracks correctly for **2** marks describes 2 or 1 track correctly for **1** mark do **not** accept hits the nucleus do **not** accept answers referring to refraction do **not** accept answers in terms of reflected backwards unless qualified in terms of repulsion mention of difference in charge on nucleus negates that track	1 max 2
total			5

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GCSE 2004
June Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Science: Double Award
Specification B (Co-ordinated)
3462/3F

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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4.2.3.1 Direct and alternating potential difference

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4.2.3.1 Direct and alternating potential difference

SCIENCE: DOUBLE AWARD CO-ORDINATED

INFORMATION FOR EXAMINERS

1. General

The mark scheme for each question shows:

- the marks available for each part of the question;
- the total marks available for the question;
- the typical answer or answers which are expected;
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:
where consequential marking needs to be considered in a calculation;
or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; e.g. allow smooth / free movement.)

3. Marking points

3.1 Marking of Quality of Written Communication

Where *Quality of written communication* appears in the mark scheme, one mark is to be awarded for either of the following points:

- Using correct scientific terms
- Correct sequencing or linking of ideas or points

The mark scheme will specify which of the points is to be awarded in a particular question. A QoWC mark can be awarded for a scientific answer, even if it is not accurate. It cannot be awarded for a nonsensical or non-scientific answer.
On the script, the QoWC tick should be identified by a 'q' written next to it.

3.2 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

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Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.3 Use of chemical symbols/formulae

If a candidate writes a chemical symbol/formula instead of a required chemical name, full credit can be given if the symbol/formula is correct and if, in the context of the question, such action is appropriate.

3.4 The marking of quantitative relationships

Full credit can be given for a correct quantitative relationship expressed in:

- named units;
- physical quantities;
- standard symbols;
- a combination of physical quantities and units.

No credit can be given for any quantitative relationship expressed in terms of:

- a combination of physical quantities, units and symbols;
- a diagram, e.g. the ohm's law triangle, unless the rest of the answer shows clearly that the candidate understands the relationships involved.

3.5 Marking procedure for calculations

3.5.1 Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.
However:

- if the answer is incorrect, mark(s) can be gained by correct substitution/working and this is shown in the 'extra information' column;
- if the answer is correct, but an incorrect relationship is written in the working, then no marks can be awarded (see 3.5.2).

3.5.2 Where calculations are based on incorrectly recalled relationships, neither the incorrectly recalled relationship, nor the resulting calculation based on the incorrect relationship, will be credited.

3.6 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

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4.2.3.1 Direct and alternating potential difference

3.7 Errors carried forward

There should be no error carried forward from a previous answer which has been based on wrong science. Any error in the answers to a structured question should be penalised once only.

Examples

(a) A candidate who calculates average speed using speed = time/distance **and** then proceeds to use this incorrect answer to calculate an acceleration based on the correct quantitative relationship should be given credit for the use of the correct acceleration relationship but none for either numerical answer.

(b) A candidate who incorrectly calculates average speed using speed = distance/time and then proceeds to use this incorrect value to calculate an acceleration based on the correct quantitative relationship, should be given credit for the use of both correct quantitative relationships **and** for the correct substitution and use of the incorrect value in the calculation of the rate of acceleration.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.8 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.9 Brackets

(…..) is used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.10 Interpretation of marginal points

There will be times when the answer is almost, but not quite, correct. Some examiners would award a mark while others would not. In any one script, an attempt should be made to balance these nearly correct answers by giving the mark on some occasions but not on others. If this is not done, the marking would end up being too lenient or too harsh.

3.11 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

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4.2.3.1 Direct and alternating potential difference

Double Award
Foundation Tier 3462/3F

3462/3F Q1

question	answers	extra information	mark
(a)	comet	correct order only	1
	elliptical		1
	Milky Way		1
	Universe		1
(b)(i)	D A C B	allow **2** marks for two letters in the correct place allow **1** mark for one letter in the correct place	3
(ii)	A		1
total			8

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4.2.3.1 Direct and alternating potential difference

3462/3F Q2

question	answers	extra information	mark
(a)	95		1
(b)	alpha	accept correct symbol	1
(c)	any **two** from: • radiation is outside the body • radiation will not reach (living) cells • radiation absorbed by the air	 accept detector is on ceiling or high up the wall accept radiation cannot pass through the body / skin accept cannot pass through the plastic casing do **not** accept because it is alpha radiation – unless qualified do **not** accept does not give off harmful substance do **not** accept cannot pass through building materials etc.	2
(d)	less (than)		1
total			5

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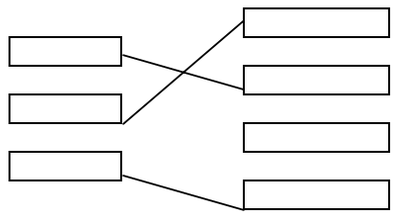
4.2.3.1 Direct and alternating potential difference

3462/3F Q3

question	answers	extra information	mark
(a)	generator	accept dynamo accept alternator	1
(b)(i)	1400	ignore units	1
(ii)	0.3 or 30%	any incorrect unit penalise **1** mark allow **1** mark for the correct use of 600 **or** 0.3% **or** 30	2
(c)	**1** mark for each correct link 	if more than 3 lines are drawn, mark only 3 lines starting with those that are incorrect	3
(d)(i)	110	no tolerance	1
(ii)	12	no tolerance	1
(iii)	wind speed may be too low to operate the generator	accept wind may not always blow accept power depends on wind speed accept does not generate if wind speed is too high accept does not generate if wind speed is above 12 (m/s) accept does not generate if wind speed is below 1.6 (m/s) accept it is unreliable do **not** accept answers referring to cost only	1
total			10

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4.2.3.1 Direct and alternating potential difference

3462/3F Q4

question	answers	extra information	mark
(a)	B E A D	allow **1** mark for each letter in the correct place, to a maximum of **3** marks	3
(b)	(a spark) may cause the (petrol vapour) to explode / ignite	accept petrol for (petrol vapour) accept catch fire for explode	1
	connect tanker to earth with a (conducting) wire / chain **or** earth the tanker	accept ground for earth	1
(c)	**Quality of written communication**	for a logical sequence	1
	any **two** from:		2
	• when current greater than fuse rating / value	accept when current too great for appliance do **not** accept 'if there is too much current' do **not** accept voltage or electricity	
	• fuse (becomes hot and) melts / burns out	accept fuse blows / breaks	
	• circuit is broken	accept circuit switched off this cannot score credit on its own	
total			8

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4.2.3.1 Direct and alternating potential difference

3462/3F Q5

question	answers	extra information	mark
(a)(i)	crust		1
(ii)	inner core is <u>solid</u> outer core is liquid	do **not** accept just rock inner core is denser / hotter than outer core gets **2** marks accept one is solid and one is liquid for **1** mark accept they are different densities for **1** mark wrong way round = **0** marks	1 1
(b)	seismograph		1
(c)	difficult to measure (slow) movement (1) of plates (1) dependent mark **or** difficult to measure friction / forces (1) between plates (1) dependent mark		1 1
(d)	geothermal		1
(e)(i)	5000		1
(ii)	2500		1
total			9

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4.2.3.1 Direct and alternating potential difference

3462/3F Q6

question	answers	extra information	mark
(a)	60		1
(b)	$5\frac{1}{2}$ hours	must include unit	1
(c)	30		1
(d)	30 minutes or $\frac{1}{2}$ hour	must include unit	1
(e)	D **and** E least steep part of the graph	accept finish for E accept correct numbers from axes with units accept covers smallest distance in a set time accept only moves 5 km in $1\frac{1}{2}$ hours (accept anything between 5 and 6) ignore horse is tired	1 1
total			6

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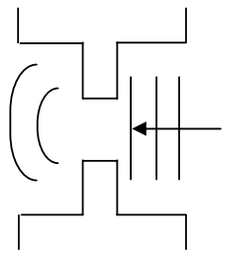
4.2.3.1 Direct and alternating potential difference

3462/3F Q7

question	answers	extra information	mark
(a)(i)	any **one** from: • (doctors) to see inside a patients body **or** endoscope • telephone cables • optical fibre / fibre optic lamps **or** (artificial) Christmas trees • data transfer **or** internet connection	 accept keyhole surgery do **not** accept flex **or** wires for cable accept decorative / ornamental lighting accept any feasible practical suggestion for taking light to a difficult to access place do **not** accept lighting unqualified do **not** accept lamp unqualified do **not** accept communications unless clarified	1
(ii)	(incident) ray angle greater than critical angle total internal reflection occurs	either order accept (incident) ray greater than 42° accept TIR do **not** accept just description of TIR	1 1
(b)(i)	waves shown diffracting in the correct direction 	ignore wavelength	1
(ii)	diffraction	accept diffract / diffracted	1
total			5

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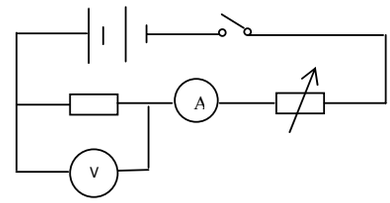
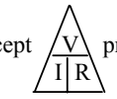
4.2.3.1 Direct and alternating potential difference

3462/3F Q8

question	answers	extra information	mark
(a)	all symbols correct	 accept push switch symbol switch may be open or closed any lines through symbols = **0** marks	1
	correct circuit drawn voltmeter must be across resistor only	polarity of cells not relevant provided they are joined correctly two cells are required in the diagram ignore the order of the components allow small gaps in circuit omission of any component = **0** marks	1
(b)(i)	potential difference = current × resistance	accept voltage or p.d. for potential difference accept $V = I \times R$ accept  provided subsequent use correct do **not** accept C for current	1
(ii)	2	allow **1** mark for correct substitution wrong working loses both marks	2
(iii)	straight line drawn <u>through the origin</u> straight line passes through $I = 0.4, V =$ their (b)(ii) / 2 **and** 0.0	judge by eye this mark may be awarded if all points shown including these points are correct even if no line is drawn N.B. a curve scores **0** marks	1 1 dep
(c)	temperature <u>increases</u>	accept filament lamp / it gets <u>hotter</u> allow heat for temperature	1
total			8

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4.2.3.1 Direct and alternating potential difference

3462/3F Q9

question	answers	extra information	mark
(a)(i)	gamma rays	accept gamma accept correct symbol	1
(ii)	infra red	accept IR	1
(b)	ultraviolet <u>absorbed</u> by ink (energy) given out as light	 accept glows / luminous accept for **both** marks the ink is fluorescent do **not** accept answers in terms of uv being reflected	1 1
(c)	any **two** from: • UV can damage / kill / ionise / alter (normal) cells • change DNA structure **or** mutate • (normal) cells may become cancerous	 do **not** accept attacks cells **or** burns skin accept may cause (skin) cancer accept abnormal cell multiplication	2
(d)(i)	microwaves **and** infra red	both answers needed in either order do **not** accept heat for IR	1
(ii)	0.9	 allow **1** mark for the <u>correct</u> use of 1.8 (kW) $(1.8 \times \frac{1}{2}$ or $1.8 \times 30)$ i.e. adding the correct 2 power values	2
total			9

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4.2.3.1 Direct and alternating potential difference

3462/3F Q10

question	answers	extra information	mark
(a)(i)	accelerating	accept getting faster accept speed / velocity increasing	1
(ii)	acceleration increases	accept velocity / speed increases more rapidly do **not** accept velocity / speed increases	1
(b)(i)	$\text{acceleration} = \frac{\text{change in velocity}}{\text{time (taken)}}$	accept $a = \frac{v - u}{t}$ **or** $a = \frac{v_1 - v_2}{t}$ do **not** accept velocity for change in velocity do **not** accept change in speed do **not** accept $a = \frac{v}{t}$	1
(ii)	15	allow **1** mark for an answer of 900 **or** for correct use of 540 seconds	2
(iii)	velocity includes direction	accept velocity is a vector (quantity) accept converse answer	1
(c)	force of gravity (between shuttle and Earth) plus correct orbital speed (makes shuttle move in a curve)	accept gravitational pull if used correctly accept forward motion **or** constant speed for orbital speed accept it is travelling fast enough accept for **2** marks the force of gravity provides the centripetal force	1 1
(d)	black is a good emitter of radiation **or** to limit the temperature rise inside the shuttle	accept heat for radiation accept the tiles are good insulation do **not** accept black absorbs heat on its own do **not** accept tiles are heat proof	1
total			9

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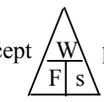
4.2.3.1 Direct and alternating potential difference

3462/3F Q11

question	answers	extra information	mark
(a)(i)	work (done) = force (applied) × distance (moved)	accept W = F × s or W = F × d accept  provided subsequent method is correct	1
(ii)	240 000 joules	allow **1** mark for correct substitution **or** correct use of 1200 (N) accept J do **not** accept j / Nm	2 1
(b)	800 (watts)	accept 0.8 kW accept their (a)(ii) ÷ 300 correctly evaluated for **2** marks allow **1** mark for correct substitution (a)(ii) ÷ 5 correctly evaluated for **1** mark	2
(c)(i)	any **one** from: • needs to raise the chair / lift • lifting more than one chair • energy transfer to the surroundings correctly qualified	 allow lifting more than 2 people implication of a heavier weight accept loss for transfer do **not** accept motor inefficient do **not** accept motor gets hot do **not** accept friction unless the location is specified as external to the motor	1
(ii)	electrical potential	accept electric **both** answers required for the mark	1
total			8

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4.2.3.1 Direct and alternating potential difference

3462/3F Q12

question	answers	extra information	mark
(a)	**Y** and **Z**		1
	they have the same number of protons **or** same atomic number	accept they have the same number of electrons **or** same number of protons **and** electrons allow only different in number of neutrons N.B. independent marks	1
(b)	**Quality of written communication**	for correct use of terms underlined in B **or** C Q ✓ Q X	1
	A – alpha particle passes straight through the empty space of the atom **or** it is a long way from the nucleus B – alpha particle <u>deflected</u> / <u>repelled</u> / <u>repulsed</u> by the (positive) <u>nucleus</u>	describes 3 tracks correctly for **2** marks describes 2 or 1 track correctly for **1** mark	max 2
	C – alpha particle heading straight for the <u>nucleus</u> is <u>deflected</u> / <u>repelled</u> / <u>repulsed</u> backwards	do **not** accept hits the nucleus do **not** accept answers referring to refraction do **not** accept answers in terms of reflected backwards unless qualified in terms of repulsion mention of difference in charge on nucleus negates that track	
total			5

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4.2.3.1 Direct and alternating potential difference

Answer 22 · Examiner comments — June 2018 | 8463/2H | Original Q3

Question 3 (Standard demand)

03.1 Just over 50% of the students scored this mark

03.2 Only 30% of students were able to use the information in Figure 3 to calculate the frequency of the wave.

03.3 Just over 75% of the students were able to write the correct equation.

03.4 Nearly 70% of the students who could recall the equation calculated the wavelength correctly.

03.5 This is a topic new to this specification. 19% of the students knew that S-waves do not travel through a liquid and could relate this to the Earth having a liquid (outer) core.

03.6 23% of the students scored the mark, generally for simply stating 'generator effect'.

Answer 22 · Examiner comments — June 2018 | 8463/2H | Original Q3

03.7 37% of students realised that this was to do with the movement of the magnet.

03.8 This was well answered with just over 76% of students choosing the correct answer.

03.9 Just over half of the students scored zero. Answers such as 'bigger magnet' or 'more coils' were too vague to gain credit.

Answer 23 · Examiner comments — November 2020 | 8463/2H | Original Q7

Question 7 (Standard/high and high demand)

07.1 Many of the students scored one mark for the idea of being able to provide a variable potential difference. A significant number of the students thought incorrectly that it would be the power output that is varied.

07.2 55% of students scored zero, often due to incorrect substitution into the chosen equation.

07.3 This was very poorly answered with very few of the students showing any knowledge of how an alternator works. The vast majority of the students started the explanation by stating that a current flows through the coil, going on to explain with varying degrees of clarity how an electric motor works. A number of the students simply described an alternating current.

07.4 There were many vague answers with only 9% of the students realising the function of the slip rings.

4.2.3.1 Direct and alternating potential difference

Answer 23 · Examiner comments

07.5 Very few of the students appeared to understand the question asked. A minority gained one mark for stating that there would be no current. A significant number of the students wrote that the current would be reduced. A statement referring to 'magnetic field' was made by a number of students but usually it was not clear which magnetic field was being referred to - that of the permanent magnets or that produced around the coil.

Concluding Remarks

Students appeared to have enough time to answer this paper and the majority had taken the time to learn the required equations.

4.2.3.1 Direct and alternating potential difference

Answer 23 · Examiner comments

November 2020 | 8463/2H | Original Q7

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

4.2.3.1 Direct and alternating potential difference

Answer 24 · Examiner comments November 2021 | 8463/1H | Original Q1

Question 1 (Common Question)
Very few students answered **01.1** correctly, but students were much more successful with equation recall and the subsequent calculations that followed, with around 80% answering **01.2** and **01.3** correctly and over 90% answering **01.4** and **01.5** correctly.

Answer 26 · Examiner comments June 2023 | 8463/1H | Original Q3

Question 3 (Standard Demand)

03.1 Very few correct answers, only 11 % of students scored a mark. Many students gave answers in terms of charge flow and current which were insufficient. The specification does not mention alternating or direct current, only alternating or direct p.d. Answers like ' the potential difference flows in one direction' were insufficient to score.
. Saying the potential difference only travels/goes in one direction was insufficient, as this suggested charge flow. Saying that 'the potential difference is always positive' or 'the potential difference doesn't go negative' were creditworthy. 'The potential difference is in one direction' was creditworthy. 'The potential difference isn't alternating' was insufficient.

03.2 Almost all students answered correctly. In this exam series, students were provided with all the equations on an Equations Sheet.

03.3 98% of students scored 3 marks on this calculation question

03.4 95% of students scored 3 marks. A small minority of students scored 2 marks, usually due to a spurious conversion of mass from kg to g.

03.5 To score in Level 2, students needed to make comparisons of the movement and arrangement of particles in ice and liquid water. In addition to this, for students to score a Level 3 mark they needed to discuss either the change of state at constant temperature increasing the potential energy of the particles or how the warming of liquid water increased the kinetic energy of the particles. For 6 marks, both these aspects needed discussion. Students found this question difficult with only 9 % scoring 5 or 6 marks and48 % scoring 3 or 4 marks. The mean mark was 3.

Answer 27 · Examiner comments June 2023 | 8463/2H | Original Q9

09.1

The topic of how motors, dynamos, generators and transformers work has always proved a challenging one, with 2% of students gaining 5 marks for this explanation. There were a number of excellent responses showing clear understanding. Many students scored some marks for describing how the coil cuts the field lines, inducing a potential difference and causing current to flow in a complete circuit. ,Only a few could clearly describe the action of the commutator and brushes swapping the connections every half-turn so the current to the lamp is only in one direction. Some students confused the dynamo for a motor or wrote answers that combined elements of both motor and dynamo. 75% of students scored at least one mark.

4.2.3.1 Direct and alternating potential difference

Answer 27 · Examiner comments

June 2023 | 8463/2H | Original Q9

09.2

17% of students could correctly draw four half-cycles to represent the output of two complete turns of the dynamo. Most drew a sine wave or an incorrect number of half-cycles.

09.3

A small number of students were able to write that without a current in the coil, there would be no magnetic field in the coil; fewer were able to state that this would remove the opposing force. Some thought there would still be a current in the coil , or that the current would increase creating an attractive force between the coil and magnets. Some students thought that friction at the brushes or the resistance of the lamp were the factors that had been reduced. 15% of students scored at least one mark on this question, with 3% getting full marks.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

4.2.3.1 Direct and alternating potential difference

Answer 28 · Examiner comments June 2025 | 8463/2H | Original Q9

9.1

Only about one quarter of the students scored the mark for explaining why a transformer core is made from iron. Many students had failed to include 'easily' with reference to iron being magnetised. Some students had incorrectly written about the conductivity of iron.

9.2

This was well done with nearly 80% of the students correctly calculating the potential difference across the primary coil. These students were able to manipulate the equation successfully and appreciated the correct order of magnitude for their answer. Common errors included not converting kV into V or failing to rearrange the equation correctly.

9.3

This question was poorly answered with students showing little understanding of the concept of induction. Just over 2 % of the students scored all 3 marks, with only about 30 % scoring at least 1 mark. Many of the students referred to a field around the primary coil, not appreciating that this field exists in the core. There were very few references to the cutting of field lines. Many students referenced potential difference being created rather than induced.

4.2.3.1 Direct and alternating potential difference

Answer 28 · Examiner comments

June 2025 | 8463/2H | Original Q9

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.