AQA GCSE Physics | 8463

SPECIFICATION POINT 4.7.3.4

Transformers (HT only)

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**38**
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.

4.7.3.4 Transformers (HT only)

Answer 01 · Mark scheme June 2004 | 3451H | Original Q13 | Legacy

The full source mark scheme begins on page 61. Follow original question 13 in that document.

Answer 02 · Mark scheme June 2004 | 3462H3 | Original Q11 | Legacy

The full source mark scheme begins on page 82. Follow original question 11 in that document.

Answer 03 · Mark scheme November 2006 | PHY1A | Original Q5 | Legacy

Five	**A**	conduction	**1**
	B	convection	**4**
	C	insulation	**2**
	D	radiation	**3**

4.7.3.4 Transformers (HT only)

Answer 04 · Mark scheme

Question 3 continued

	answers	extra information	mark
(c)(i)	any **two** from: • using renewable energy • make non-renewable fuels last longer • non-renewable fuels can be used for other processes • no pollutant gases produced • land can still be used for farming	any two valid points gains the marks accept don't use up non-renewable / fossil fuels accept named fuels accept the opposite of (b) ignore no pollution ignore economic issues	2
(ii)	any **two** from: • cause noise pollution • cause visual pollution • may interfere with TV / radio / mobile phone signals • need to put in new infrastructure • not reliable owtte • dangerous to birds • lots of concrete needed for the bases **or** producing cement is environmentally damaging	accept spoils the landscape accept sunlight flicker accept new roads needed accept reduces house prices ignore any references to cost / jobs / number required ignore takes up a lot of land accept reference to obstruction of shipping etc. if clear reference to offshore wind farm	2
total			9

4.7.3.4 Transformers (HT only)

Answer 04 · Mark scheme

June 2007 | PHY1H | Original Q3 | Legacy

PHY1H Question 4

	answers	extra information	mark
(a)	wavelength increases	accept the crests are further apart ignore waves are further apart	1
	frequency decreases	accept pitch decreases ignore references to amplitude	1
(b)	stars / galaxies / sources emit all / different types of electromagnetic waves / radiation	accept two or more named electromagnetic waves accept answers in terms of frequencies / wavelengths	1
(c)(i)	wavelength (of light) increases **or** light moves to red end of spectrum	accept frequency decreases accept redder but do **not** accept red alone	1
(ii)	it is the star (detected) <u>furthest</u> from the Earth **or** it is moving <u>away</u> the fast<u>est</u>	accept galaxy for stars ignore reference to universe expanding	1
(d)(i)	all matter compressed to / starts at / comes from a single point	do **not** accept increasing gravitational pull accept everything / the universe for all matter	1
	(massive) <u>explosion</u> sends matter outwards	accept <u>explosion</u> causes universe to expand ignore explosion creates the universe **or** further reference to star / Earth formation	1

Continued on next page

4.7.3.4 Transformers (HT only)

Answer 05 · Mark scheme

November 2007 | PHY1A | Original Q8 | Legacy

Eight	**3**	**3**	**2**	**1**

4.7.3.4 Transformers (HT only)

Answer 06 · Mark scheme

Question 1

question	answers	extra information	mark
(a)(i)	any **one** from: • coal • oil • (natural) gas	do **not** accept fossil fuels accept diesel accept biofuel or a named biofuel eg wood / straw accept household / industrial waste owtte	1
(ii)	0.3	accept 30% if **2** marks not awarded then: allow **1** mark for 30 (without %) allow **1** mark for 0.3 with a unit or % allow **1** mark for identification of energy input and output eg 20 sq input and 6 sq output **or** 4 sq input and 1.2 sq output **or** 40 sq input and 12 sq output even if subsequent working incorrect allow **1** mark for correct expression of 1.2 over 4 **or** 12 over 40 **or** 6 over 20 (squares)	2
(iii)	(nuclear) fission	accept fision provided it is **not** fusion	1

Question 1 continues on the next page

PHY1H

Question 1 continued

question	answers	extra information	mark
(b)(i)	small proportion of energy / power is wasted **or** transfers most / more / a lot of energy power usefully	accept little / less energy / power / heat is wasted do **not** accept it wastes no energy / power	1
(ii)	it decreases the current / uses low current **or** it increases the voltage / potential difference **or** uses high voltage / potential difference smaller the current the smaller the energy loss	 accept pd for potential difference accept power / heat for energy	1 1
(c)(i)	as a control	accept to make a comparison do **not** accept fair test on its own	1
(c)(ii)	so people know how much data the link was based on **or** people can judge the significance / reliability of the link	accept idea that larger numbers are better do **not** accept significance / reliability on its own ignore reference to accuracy	1

Question 1 continues on the next page

PHY1H

Question 1 continued

question	answers	extra information	mark
(iii)	other possible factors may be responsible **or** have not been investigated named factor eg environment / genetic		1 1
(iv)	first box ticked plus reason **or** second box plus reason	acceptable reason such as so people know there may be a risk as soon as possible / so that other scientists can use findings acceptable reason such as no point to worry / confuse / panic people *(*until the research has been confirmed*)* accept idea that it may lead to wrong advice do **not** accept in case they are wrong	1
total			12

4.7.3.4 Transformers (HT only)

Answer 06 · Mark scheme

January 2008 | PHY1H | Original Q1 | Legacy

PHY1H

4.7.3.4 Transformers (HT only)

Answer 07 · Mark scheme January 2008 | PHY3H | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
(a)(i)	step-down (transformer) because fewer turns on the output/secondary (coil)	no credit for just 'step-down transformer' accept '…less turns…' do **not** credit '…fewer coils…' **or** 'the p.d. across the input / primary will be greater than the p.d. across the output / secondary'	1
(ii)	to prevent a short (circuit)(through the turns of wire or through the core	do **not** credit references to safety **or** heat (insulation)	1
(iii)	(easily) magnetised (and demagnetised)	accept '(it's) magnetic' do **not** accept 'because it's a conductor'	1
(b)	2250	correct substitution eg $\frac{150}{\text{p.d. across secondary}} = \frac{500}{7500}$ gains **1** mark **or** appropriate transformation eg (p.d. across secondary =) $\frac{\text{number of turns on secondary}}{\text{number of turns on primary}} \times$ p.d. across primary gains **1** mark	2

continued

4.7.3.4 Transformers (HT only)

Answer 07 · Mark scheme

PHY3H

Question 6 continued

question	answers	extra information	mark
(c)	any **two** from: • to reduce the voltage / p.d. (of the domestic supply) • higher voltage difficult to insulate • higher voltage (would) result in (fatal) electric shock • domestic appliances are not designed for (very) high voltage (input) / (are designed) for 230V	**or** to reduce to 230 V allow 'to reduce to 240 V' do **not** credit 'reduce current to 230V' **not** just 'less dangerous' do **not** credit 'to increase efficiency' / 'to save energy' do **not** credit just 'it's safer'	2
(d)	any **two** (1) each • if the (local) power station breaks down / fails / demand / load exceeds supply • electricity / power can be switched from elsewhere in the system / from other power station(s) • electricity can be generated in places remote from customers • (in total) fewer power stations are needed • power available in rural / remote areas • National Grid allows for (better) control of supply and demand	**or** words to that effect **or** words to that effect **or** words to that effect do **not** credit just cheaper / more efficient / safer	1 1
total			9

4.7.3.4 Transformers (HT only)

Answer 07 · Mark scheme January 2008 | PHY3H | Original Q6 | Legacy

PHY3H

Answer 08 · Mark scheme March 2008 | PHY1AP | Original Q1 | Legacy

Question	Key		
One	**A**	conduction	**3**
	B	convection	**2**
	C	insulation	**4**
	D	radiation	**1**

4.7.3.4 Transformers (HT only)

Answer 09 · Mark scheme June 2008 | PHY3H | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
(a)	10 500	allow **1** mark for 75 × 32 200 ÷ 230	2
(b)	any **three** from: • alternating current (a.c.) in the primary (coil) • produces a **changing** magnetic field / flux (in the core) • which is made of (laminated soft) iron • this induces • an alternating potential difference across the secondary coil	 must be idea of inducing something in the secondary coil accept voltage for potential difference	3
total			5

4.7.3.4 Transformers (HT only)

Answer 09 · Mark scheme June 2008 | PHY3H | Original Q6 | Legacy

PHY3H

4.7.3.4 Transformers (HT only)

Answer 10 · Mark scheme January 2009 | PHY3H | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)(i)	(quickly) becomes magnetised	**or** (quickly) loses its magnetism **or** 'it's *(a)* magnetic *(*material*)*' any reference to conduction of electricity/heat nullifies the mark	1
3(a)(ii)	any **four** from: • insulation prevents electricity/current flowing through the iron/core • <u>alternating</u> current/a.c. in the primary (coil) • produces a <u>changing</u> magnetic field (in the iron/core) • (and hence magnetic) field in the secondary (coil) • induces/generates/ produces an <u>alternating</u> potential difference/p.d./ voltage across the secondary (coil) • (and hence) <u>alternating</u> current/a.c. in the secondary (coil)	**or** 'insulation so electricity/ current only flows in the wires/turns/coils'	4

Question 3 continues on the next page

PHY3H

Question 3 continued

question	answers	extra information	mark
3(b)	80 (turns)	**or** credit (1) for any equation which <u>if correctly evaluated</u> would give 80 example $\frac{230}{5.75} = \frac{3200}{\text{number of turns}}$	2
Total			**7**

4.7.3.4 Transformers (HT only)

Answer 10 · Mark scheme January 2009 | PHY3H | Original Q3 | Legacy

PHY3H

Answer 11 · Mark scheme March 2009 | PHY1AP | Original Q2 | Legacy

Two	**A**	falling water (hydroelectric)	**2**
	B	fossil fuel	**1**
	C	tides	**4**
	D	wind	**3**

Answer 12 · Mark scheme June 2009 | PHY1AP | Original Q5 | Legacy

Five	**2**	**3**	**2**	**4**

4.7.3.4 Transformers (HT only)

Answer 13 · Mark scheme

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**

4.7.3.4 Transformers (HT only)

Answer 13 · Mark scheme

June 2009 | PHY3H | Original Q1 | Legacy

PHY3H

Answer 14 · Mark scheme

November 2009 | PHY1AP | Original Q5 | Legacy

Five	**2**	**4**	**4**	**3**

4.7.3.4 Transformers (HT only)

Answer 15 · Mark scheme

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**

4.7.3.4 Transformers (HT only)

Answer 15 · Mark scheme

January 2010 | PHY3H | Original Q5 | Legacy

PHY3H

Answer 16 · Mark scheme

March 2010 | PHY1AP | Original Q9 | Legacy

Nine	**2**	**2**	**2**	**4**

4.7.3.4 Transformers (HT only)

Answer 16 · Mark scheme

SCIENCE A (4461)/PHYSICS (4451)

Objective Test Answer Key

PHY1AP (Energy and Electricity)

March 2010

Higher Tier

Question	Key		
One	**A**	0.25	**4**
	B	60	**3**
	C	100	**1**
	D	240	**2**
Two	**A**	computer monitor	**1**
	B	loudspeaker	**3**
	C	microphone	**2**
	D	solar cell	**4**

	A	B	C	D
Three	**3**	**3**	**1**	**2**
Four	**2**	**2**	**2**	**4**
Five	**3**	**2**	**2**	**4**
Six	**4**	**4**	**4**	**3**
Seven	**4**	**4**	**2**	**1**
Eight	**3**	**3**	**2**	**2**
Nine	**1**	**4**	**4**	**1**

4.7.3.4 Transformers (HT only)

Answer 17 · Mark scheme

June 2010 | PHY1AP | Original Q9 | Legacy

Nine	2	3	3	2

4.7.3.4 Transformers (HT only)

Answer 18 · Mark scheme

June 2010 | PHY1H | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)(i)	tidal / tides	do **not** accept water / waves	1
5(a)(ii)	any **three** from: • shorter journey time • less pollution from traffic • energy source is free • energy source / tides are predictable • produces less / no pollutant gases (than fuel burning power stations) • conserves supplies of fossil fuels • uses renewable energy (to generate electricity) • provides employment • no visual / noise pollution	accept easier to go from town to town accept less petrol / fuel used accept CO_2 / carbon emissions reduced accept no CO_2 / greenhouse gases produced accept air pollution for pollutant gases less harm to the environment is insufficient the electricity is cheaper is insufficient do **not** accept produces no radioactive waste the pollution mark scores twice only if it is clear one reference is to traffic and the other is to electricity generation	3

Question 5 continues on the next page . . .

4.7.3.4 Transformers (HT only)

Answer 18 · Mark scheme

June 2010 | PHY1H | Original Q5 | Legacy

PHY1H

Question 5 continued . . .

question	answers	extra information	mark
5(b)(i)	(sometimes) electricity demand may be greater than supply (of electricity from the system) **or** can sell (excess) electricity (to the National Grid)	accept in case turbines / generators fail	1
5(b)(ii)	decreases the current reducing energy loss (along cables)	accept increases the voltage accept less heat / thermal energy lost / produced	1 1
Total			**7**

4.7.3.4 Transformers (HT only)

Answer 18 · Mark scheme June 2010 | PHY1H | Original Q5 | Legacy

PHY1H

4.7.3.4 Transformers (HT only)

Answer 19 · Mark scheme

June 2010 | PHY3H | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)	(it is) magnetic	**or** will carry (an alternating) magnetic field **or** magnetises and demagnetises (easily) reference to conduction negates the mark	1
3(b)	so the current / electricity does not flow through the iron / core	accept 'so the current / electricity / wires do not short (circuit)' responses in terms of heat insulation negate the mark ignore references to safety	1
3(c)	5.75 or 5.8 or 6(.0) V / volt(s)	allow for **1** mark **either** $\frac{230}{\text{p.d.}} = \frac{20\,000}{500}$ **or** p.d. = 230 ÷ 40	2 1
Total			**5**

4.7.3.4 Transformers (HT only)

Answer 19 · Mark scheme June 2010 | PHY3H | Original Q3 | Legacy

PHY3H

Answer 20 · Mark scheme November 2010 | PHY1AP | Original Q7 | Legacy

Seven	**3**	**4**	**2**	**1**

4.7.3.4 Transformers (HT only)

Answer 21 · Mark scheme

Question 4

question	answers	extra information	mark
4(a)(i)	kinetic	accept KE do **not** accept movement	1
4(a)(ii)	0.75 **or** 75 %	allow **1** mark for correct substitution ie $\frac{60\,000}{80\,000}$ an answer 0.75 % **or** 0.75 with a unit gains **1** mark only an answer 75 with or without a unit gains **1** mark only	2
4(b)	any **one** from: • large areas of land are flooded • peoples homes may be destroyed • habitat (of animals and plants) lost / damaged	 uses large areas of land / takes up large areas of land is insufficient construct is neutral very noisy is neutral	1

Question 4 continues on the next page . . .

4.7.3.4 Transformers (HT only)

PHY1H

Question 4 continued . . .

question	answers	extra information	mark
4(c)(i)	system of cables and transformers	both required for the mark accept power lines / wires for cables ignore reference to pylons inclusions of power stations / consumers negates answer	1
4(c)(ii)	less energy loss / wasted (in the cables) as the cables are shorter	accept heat for energy do **not** accept no energy loss do **not** accept electricity for energy	1 1
Total			**7**

4.7.3.4 Transformers (HT only)

Answer 21 · Mark scheme January 2011 | PHY1H | Original Q4 | Legacy

PHY1H

4.7.3.4 Transformers (HT only)

Answer 22 · Mark scheme

January 2011 | PHY3H | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)	10	allow **1** mark for correct substitution ie $\frac{230}{Vs} = \frac{4600}{200}$	2
4(b)	any **one** from: • to prevent short circuiting • to ensure that the current flows / goes round the coil • to prevent the current entering the core	do **not** accept electrocution do **not** accept electricity for current answers including heat / energy loss negate mark	1
4(c)(i)	(soft) iron	do **not** accept 'steel'	1
4(c)(ii)	can be magnetised because it is magnetic	answers including it's a conductor negate mark	1
Total			**5**

4.7.3.4 Transformers (HT only)

Answer 22 · Mark scheme January 2011 | PHY3H | Original Q4 | Legacy

PHY3H

Answer 23 · Mark scheme March 2011 | PHY1AP | Original Q8 | Legacy

Eight	**2**	**4**	**2**	**4**

Answer 24 · Mark scheme June 2011 | PHY1AP | Original Q7 | Legacy

Seven	**3**	**3**	**2**	**1**

4.7.3.4 Transformers (HT only)

Answer 25 · 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

4.7.3.4 Transformers (HT only)

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) <u>alternating / changing</u> (magnetic) field in the (iron) core <u>induces</u> (alternating) p.d. across the <u>secondary</u> (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**

4.7.3.4 Transformers (HT only)

Answer 26 · Mark scheme

November 2011 | PHY1AP | Original Q6 | Legacy

Six	**1**	**2**	**3**	**4**

4.7.3.4 Transformers (HT only)

Answer 27 · 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

4.7.3.4 Transformers (HT only)

Answer 28 · Mark scheme

3(a)	on page 5, and apply a 'best-fit' approach to the marking.		**6**	**rel**
0 marks	**Level 1 (1–2 marks)**	**Level 2 (3–4 marks)**	**Level 3 (5–6 marks)**	AO1 3.3.2
No relevant / correct content.	**Either** there is an attempt at a description of the construction of a transformer **or** a correct statement of the effect of one type of transformer on the input p.d.	There is a description of the construction of a transformer **and** a correct statement of the effect of one type of transformer on the input p.d.	There is a clear description of the construction of a transformer **and** there is a correct description of how transformers affect the input p.d.	

details of construction:	extra information
a (laminated) core	
core is made from a magnetic material / iron	
2 coils	
the coils are made from an electrical conductor / copper	
the coils are covered in plastic / insulation	
the coils are (usually) on opposite sides	
step-up transformer has more turns on secondary coil than (its) primary (or vice versa)	
step-down transformer has less turns on secondary coil than (its) primary (or vice versa)	
effect on input p.d. :	
step-up transformer, the output p.d. is greater (than the input p.d.)	accept voltage for p.d.
step-down transformer, the output p.d. is lower (than the input p.d.)	

Question 3 continues on the next page . . .

4.7.3.4 Transformers (HT only)

Answer 28 · Mark scheme

June 2014 | PH3HP | Original Q3 | Legacy

Question 3 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
3(b)	switch mode (transformer)		1	AO1 3.3.2j
Total			**7**	

4.7.3.4 Transformers (HT only)

Answer 29 · 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	

4.7.3.4 Transformers (HT only)

Answer 30 · 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 . . .

4.7.3.4 Transformers (HT only)

Answer 30 · 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	

4.7.3.4 Transformers (HT only)

Answer 30 · Mark scheme

June 2016 | PH3HP | Original Q2 | Legacy



4.7.3.4 Transformers (HT only)

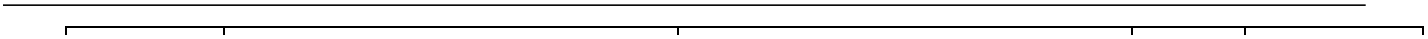
Answer 31 · Mark scheme June 2017 | PH1HP | Original Q7 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)	transformer **J** increases the voltage and decreases the current	allow steps up for increases	1	AO1 1.4.2a,b,c
	(so lower current means) less energy wasted **or** less heating of the surroundings	allow heat for energy	1	
	(which) increases efficiency		1	
	(but) transformer **K** decreases the voltage to a safer / appropriate value (for consumers)	allow steps down for decreases if no other mark scored then allow **1** mark for transformer **J** is a step-up transformer <u>and</u> transformer **K** is a step-down transformer	1	
7(b)(i)	at times of low demand (for electricity)		1	AO1 1.4
	when there is a surplus (of electricity)		1	
	water is pumped from low level to high level	accept the turbine acts as a pump **or** the generator acts as a motor	1	
	energy is stored as gravitational potential energy	allow gpe for gravitational potential energy	1	
7(b)(ii)	can store / produce large amount of energy		1	AO1 1.4
	(means) power output increases rapidly	accept short start-up time	1	
Total			**10**	

4.7.3.4 Transformers (HT only)

Answer 31 · Mark scheme

June 2017 | PH1HP | Original Q7 | Legacy



4.7.3.4 Transformers (HT only)

Answer 32 · Mark scheme June 2018 | 8463/2H | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	any **one** from: • too few turns / coils on the secondary • p.d. across the primary was reduced	allow number of turns / coils on the primary was increased ignore human error	1	AO3 4.7.3.4
07.2	the p.d. (across the secondary) goes above 2V	allow p.d. across secondary is higher than p.d. across primary after 20 turns	1	AO3 4.7.3.4
07.3	it increases (until the nails reach a constant temperature)		1	AO1 4.6.3.1

4.7.3.4 Transformers (HT only)

Answer 32 · Mark scheme

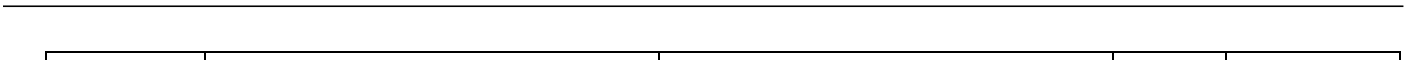
June 2018 | 8463/2H | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4		an answer of 1.2 (A) scores **5** marks		AO2 4.7.3.4
	$\frac{640}{4} = \frac{V_p}{1.75}$		1	
	$V_p = \frac{640 \times 1.75}{4}$		1	
	$V_p = 280$ (V)		1	
	$280 \times I_p = 336$	allow their calculated $V_p \times I_p = 336$	1	
	$I_p = 1.2$ (A)	allow an answer that is consistent with their calculated value of V_p	1	
	or			
	$336 = I_s \times 1.75$ (1)			
	$I_s = \frac{336}{1.75}$ (1)			
	$I_s = 192$ (A) (1)			
	$I_p = 192 \times \frac{4}{640}$ (1)	allow I_p = their calculated $I_s \times \frac{4}{640}$		
	$I_p = 1.2$ (A) (1)	allow an answer that is consistent with their calculated value of I_s		
Total			**8**	

4.7.3.4 Transformers (HT only)

Answer 32 · Mark scheme

June 2018 | 8463/2H | Original Q7



4.7.3.4 Transformers (HT only)

Answer 33 · 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

4.7.3.4 Transformers (HT only)

Answer 33 · Mark scheme

November 2020 | 8463/2H | Original Q7

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**	

4.7.3.4 Transformers (HT only)

Answer 34 · Mark scheme

June 2022 | 8463/1H | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	transformer **X** increases potential difference		1	AO1 4.2.4.3
	and decreases current	do not accept if student states that potential difference decreases	1	
	reducing (thermal) energy transfer to surroundings **or** reducing (thermal) energy transfer from transmission cables	do not accept no energy transfer to surroundings	1	
	increasing the efficiency (of power transmission)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	transformer **Y** decreases the potential difference		1	AO1 4.2.4.3
	to a safe / safer value	dependent on scoring 1st marking point	1	

4.7.3.4 Transformers (HT only)

Answer 34 · Mark scheme

June 2022 | 8463/1H | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	$3.24 \times 10^{11} = Q \times 230$		1	AO2 4.2.4.2
	$Q = \frac{3.24 \times 10^{11}}{230}$		1	
	Q = 1 408 695 652 (C)		1	
	$Q = 1.41 \times 10^{9}$ (C) **or** *Q* = 1 410 000 000 (C)	allow correct rounding of an incorrect answer using data from the question	1	

Total Question 6		**10**

4.7.3.4 Transformers (HT only)

Answer 35 · 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	

4.7.3.4 Transformers (HT only)

Answer 35 · 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**

4.7.3.4 Transformers (HT only)

Answer 36 · Mark scheme

June 2023 | 8463/1H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	increase decrease	must be in this order	1 1	AO1 4.2.4.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	$P = I^2R$		1	AO1 4.2.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	$1.60 \times 10^9 = 2000^2 \times R$ $R = \frac{1.60 \times 10^9}{2000^2}$ $R = 400\ (\Omega)$		1 1 1	AO2 4.2.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	efficiency = $\frac{\text{useful energy output}}{\text{total energy input}}$ **or** efficiency = $\frac{\text{useful output energy transfer}}{\text{total input energy transfer}}$		1	AO1 4.1.2.2

4.7.3.4 Transformers (HT only)

Answer 36 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	$0.992 = \frac{\text{useful energy output}}{34.2}$ useful energy output $= 0.992 \times 34.2$ useful energy output = 33.9 (GJ)	 allow a correct answer given to more than 3 s.f.	1 1 1	AO2 4.1.2.2

Total Question 1	**10**

4.7.3.4 Transformers (HT only)

Answer 37 · Mark scheme

June 2023 | 8463/2H | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	iron	allow nickel / cobalt do not allow steel	1	AO1 4.7.3.4
	it is easily magnetised (and demagnetised)	allow it is a magnetic material MP 2 is dependent on MP 1	1	

4.7.3.4 Transformers (HT only)

Answer 37 · Mark scheme

June 2023 | 8463/2H | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	$\frac{230}{V_s} = \frac{2000}{40}$		1	AO2 4.7.3.4
	$V_s = \frac{40}{2000} \times 230$	subsequent marks can only be awarded if the first equation is correct and has been used	1	
	$V_s = 4.6$ (V)		1	
	$4.6 \times I_s = 6.9$	this mark may be awarded if the pd is incorrectly calculated	1	
	$I_s = 1.5$ A	allow a correctly calculated I_s using an incorrectly calculated pd	1	
	OR			
	$6.9 = I_p \times 230$ (1)			
	$I_p = \frac{6.9}{230}$ (1)	subsequent marks can only be awarded if the first equation is correct and has been used		
	$I_p = 0.03$ (A) (1)			
	$I_s = 0.03 \times \frac{2000}{40}$ (1)	this mark may be awarded if I_p is incorrectly calculated		
	$I_s = 1.5$ (A) (1)	allow a correctly calculated I_s using an incorrectly calculated I_p		

Total Question 8	7

4.7.3.4 Transformers (HT only)

Answer 38 · 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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4.7.3.4 Transformers (HT only)

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4.7.3.4 Transformers (HT only)

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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4.7.3.4 Transformers (HT only)

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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4.7.3.4 Transformers (HT only)

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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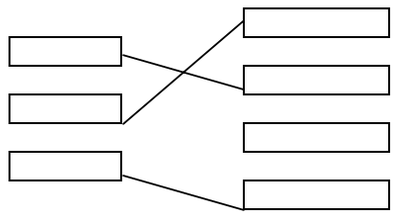
4.7.3.4 Transformers (HT only)

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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4.7.3.4 Transformers (HT only)

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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4.7.3.4 Transformers (HT only)

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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4.7.3.4 Transformers (HT only)

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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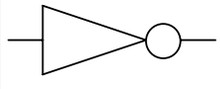
4.7.3.4 Transformers (HT only)

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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4.7.3.4 Transformers (HT only)

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	accept finish for E accept correct numbers from axes with units	1
	least steep part of the graph	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
total			6

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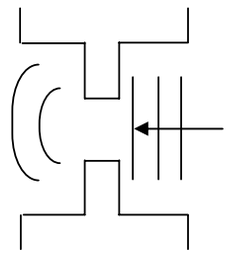
4.7.3.4 Transformers (HT only)

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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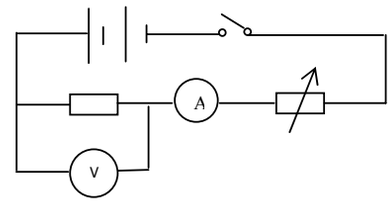
4.7.3.4 Transformers (HT only)

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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4.7.3.4 Transformers (HT only)

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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4.7.3.4 Transformers (HT only)

3451F Q12

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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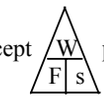
4.7.3.4 Transformers (HT only)

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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4.7.3.4 Transformers (HT only)

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)	input sensor → controlled by the processor processor → detects changes in the environment output device → decides what action is needed	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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4.7.3.4 Transformers (HT only)

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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4.7.3.4 Transformers (HT only)

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 <u>deflected</u> / <u>repelled</u> / <u>repulsed</u> by the (positive) <u>nucleus</u> C – alpha particle heading straight for the <u>nucleus</u> is <u>deflected</u> / <u>repelled</u> / <u>repulsed</u> 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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4.7.3.4 Transformers (HT only)

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4.7.3.4 Transformers (HT only)

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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4.7.3.4 Transformers (HT only)

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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4.7.3.4 Transformers (HT only)

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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4.7.3.4 Transformers (HT only)

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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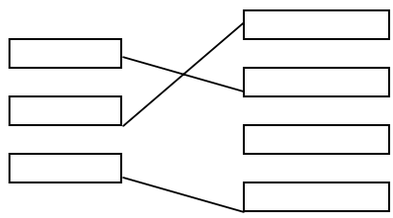
4.7.3.4 Transformers (HT only)

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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4.7.3.4 Transformers (HT only)

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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4.7.3.4 Transformers (HT only)

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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4.7.3.4 Transformers (HT only)

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	accept finish for E accept correct numbers from axes with units	1
	least steep part of the graph	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
total			6

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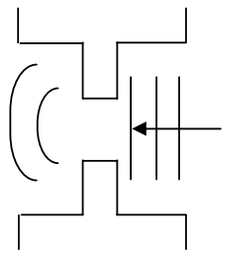
4.7.3.4 Transformers (HT only)

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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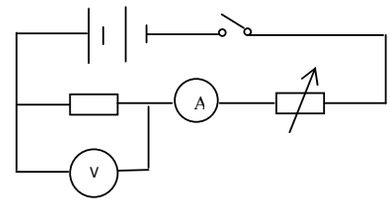
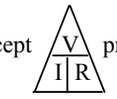
4.7.3.4 Transformers (HT only)

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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4.7.3.4 Transformers (HT only)

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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4.7.3.4 Transformers (HT only)

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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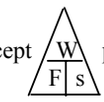
4.7.3.4 Transformers (HT only)

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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4.7.3.4 Transformers (HT only)

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 deflected / repelled / repulsed by the (positive) nucleus C – alpha particle heading straight for the nucleus is deflected / repelled / repulsed backwards	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	max 2
total			5

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4.7.3.4 Transformers (HT only)

Answer 32 · Examiner comments

June 2018 | 8463/2H | Original Q7

Question 7 (Standard/high and High demand)

07.1 Many students had the correct idea, but imprecise detail such as ‘wrong number of turns’ or ‘number of turns was miscounted’ were insufficient to score the mark.

07.2 Many students tried to answer the question from a general knowledge about transformers, rather than using information from the graph, and so did not gain credit.

07.3 Most of the answers were correct. A very small number of students wrote ‘hotter’ but made no reference to infrared or thought it was just a temperature increase.

07.4 This question involved a two stage calculation, a new feature of the examination. Nearly 33 % of students knew the equations to use and how to use them, scoring all five marks. A further 35% of students correctly used one equation to give a partially correct answer, scoring three marks.

Answer 33 · 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.

4.7.3.4 Transformers (HT only)

Answer 33 · Examiner comments

November 2020 | 8463/2H | Original Q7

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.

4.7.3.4 Transformers (HT only)

Answer 33 · Examiner comments

Mark Ranges and Award of Grades

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

4.7.3.4 Transformers (HT only)

Answer 36 · Examiner comments June 2023 | 8463/1H | Original Q1

Question 1 (Standard Demand)

01.1 71% of students scored 2 marks on this question about transformers.

01.2 98% of students identified the correct equation. In this exam series, students were provided with all the equations on an Equations Sheet.

01.3 86% of students scored 3 marks. Many students failed to square the current so scored zero for the substitution and subsequent rearrangement.

01.4 84% of students answered correctly. In this exam series, students were provided with all the equations on an Equations Sheet. Students who quoted the version of the efficiency equation with power input and power output scored zero.

01.5 95% of students scored 3 marks. An answer of 33.9264 scored 3 marks as significant figures was not being tested in this question part. An answer given to 2 s.f. could score 3 marks with working. If the answer was rounded, the rounding needed to be correct.

Answer 37 · Examiner comments June 2023 | 8463/2H | Original Q8

08.1

Most students knew that iron is used for the core of a transformer and most of those were able to give an explanation. A significant number of students thought that iron was used because it is a good conductor of electricity, which demonstrates a misunderstanding of how transformers work.

08.2

55% of students gainiedall5 marks Most of the other students scored at least 3 marks for a partially correct answer. There were alternative ways of calculating the correct answer using the transformer and power equations, and it was pleasing to see so many students having the confidence to use them appropriately.

4.7.3.4 Transformers (HT only)

Answer 38 · 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.

4.7.3.4 Transformers (HT only)

Answer 38 · 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.

4.7.3.4 Transformers (HT only)

AQA

GCSE
PHYSICS

8463/1H: Paper 1 (Higher tier)
Report on the Examination

8463
June 2022

Version: 1.0

4.7.3.4 Transformers (HT only)

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General

Grade 4-5 calculation questions ask for students to recall an equation, before using it in a subsequent calculation. In the 2022 series, students were given an Equations Sheet which had all the equations printed on it. Subsequently, the performance on the more straightforward calculations has improved on previous years.

The multistep calculations targeted at candidates working at grades 8-9, questions **09.1** and **10.1**, were well attempted with many students answering correctly. Of these two questions, students were slightly more successful on question **09.1** with about 55% of students scoring full marks, whereas for question **10.1** approximately 45% of students scored full marks.

Question **02.1** was generally well attempted and students who had carried out the density required practical had an advantage over those who hadn't. For this question, about 35% of students scored 6 marks and approximately 25% of students scored 5 marks.

Handwriting continues to be a problem for a number of students, making it very difficult for examiners to read what has been written. Students who have handwriting that is difficult to read may benefit from a scribe or from word processing their answers in exams.

Question 11

Due to incorrect Advance Information guidance being issued for this question, and to avoid students being disadvantaged, Question 11 was discounted and all students were awarded full (9) marks.

Levels of demand

Questions are set at three levels of demand for this paper:

- **Standard demand** questions are designed to broadly target grades 4–5.
- **Standard/high demand** questions are designed to broadly target grades 6–7.
- **High demand** questions are designed to broadly target grades 8–9.

A student's final grade, however, is based on their attainment across the qualification as a whole, not just on questions that may have been targeted at the level at which they are working.

4.7.3.4 Transformers (HT only)

Question 1 (Standard demand)

01.1 About 55% of students scored 2 marks. The unit conversion caused a problem for many students and powers of 10 errors were frequently seen. A correct calculation using an incorrectly or not converted value for power would score 1 mark.

01.2 Students were generally successful at answering this question with approximately 40% scoring 2 marks and about 50% scoring 1 mark. Most students wrote variations of the first and third bullet points in the markscheme. A number of students wrote that the turbines may be broken, which was enough to score a mark for the idea of maintenance.

01.3 'Turbine will rotate faster' was insufficient to score a mark. 'Rotate more smoothly' was not enough to score the 'less friction' mark. Students who stated that 'no energy was wasted' did not score the second marking point. Approximately 35% of students scored 3 marks, 35% of students scored 2 marks and 20% of students scored 1 mark.

01.4 About 30% of students scored 2 marks, while approximately 50% of students scored 1 mark. Many students answered in terms of 'saving energy' which was insufficient. Other students answered in terms of absolute statements which did not score, 'energy efficient appliances waste no energy' for example.

Question 2 (Standard demand)

02.1 Generally very well answered with about 35% of students gaining 6 marks and 25% scoring 5 marks. Students were told that this required practical would appear in the 2022 series via the Advance Information. A number of students quoted the density equation incorrectly, although this was given on the Equations Sheet for the 2022 series. There were extremely few students who didn't attempt the question and less than 1% of students who attempted the question scored zero.

02.2 Approximately 85% of students answered this question correctly. Of the incorrect answers seen, a significant proportion gave the maximum and minimum values the wrong way round. Another common mistake was to write maximum: 2.55 and minimum 0.10, which showed a clear misunderstanding of expressing an uncertainty.

02.3 About 95% of students answered this question correctly.

02.4 Approximately 45% of students scored 2 marks and 40% scored 1 mark. 'In case an error / mistake was made the first time' was insufficient. 'To check the repeatability of the data' was ignored, as this wouldn't improve the accuracy of the data. 'Get rid of anomalies' was assumed to mean 'remove anomalies', but 'stops anomalies from occurring' did not score. Likewise 'stops random errors' did not score.

4.7.3.4 Transformers (HT only)

Question 3 (Standard demand)

03.1 Over 99% of students answered this question correctly as they had all the Physics equations on the Equations Sheet for the 2022 series.

03.2 Nearly 95% of students answered this question correctly. In this series all students were given all the equations on the Equations Sheet. The first mark is for the substitution into the equation as it appears on the equations sheet. Some students failed to score any marks by incorrectly rearranging the equation, then substituting into the incorrectly rearranged equation.

03.3 Over 99% of students answered this question correctly as they had all the Physics equations on the Equations Sheet for the 2022 series.

03.4 95% of students answered this question correctly. In this series all students were given all the equations on the Equations Sheet. The first mark is for the substitution into the equation as it appears on the Equations Sheet. Some students failed to score any marks by incorrectly rearranging the equation, then substituting into the incorrectly rearranged equation.

Question 4 (Standard/High demand)

04.1 A large number of students found it difficult to identify the independent and dependent variables in the investigation that was described. Control variables appeared often in students' answers. 'Temperature change' seemed to be the most common incorrect answer for the dependent variable. About 50% of students scored 2 marks and approximately 35% of students scored 1 mark.

04.2 65% of students answered correctly. The most common incorrect answer was 87.4 °C.

04.3 About 35% of students answered this question correctly. Common incorrect answers referred to the resolution, or just repeated the question and said 'difficult to read' which was insufficient.

04.4 Approximately 75% of students scored 3 marks and about 10% of students scored 2 marks. Power of 10 errors were common and usually resulted in 2 marks being scored for an incorrectly or not converted value of energy.

04.5 Many students found relating the time for the temperature to decrease to thermal conductivity difficult. About 15% of students scored 2 marks, while 40% scored 1 mark. Answers in terms of good / bad insulators were insufficient to score a mark.

Question 5 (Standard/High demand)

05.1 Approximately 45% of students scored 1 mark, with about 5% of students scored 3 marks. Around 30% of students scored no marks. The first marking point of this explanation was most likely to score, the third marking point was least likely to score.

05.2 About 30% of students scored all 3 marks for this explanation. 10% of students scored 2 marks and 10% scored 1 mark. A lot of student answers were not creditworthy, with mixed up descriptions of ion transfer, electron transfer, proton transfer, protons weighing more than electrons and transfer of electrons increasing the mass of the rod on the balance. As a result about 50% of students scored zero.

05.3 Approximately 60% of students scored the mark. Some students evidently did not know what a zero error was. Answers like 'it means there is no error' being a good example of this. Some answers were insufficient, 'the actual mass of the rod is not required' being not enough to score the mark. 'Weight' was allowed for 'mass' when used correctly as the reading on the balance does depend on the weight of the object. An answer of 'only the change in weight was needed' would have scored the mark.

05.4 Some very good explanations were seen and about 10% of students scored all 3 marks. The first marking point was least likely to score. The third marking point needed to be linked to the second marking point before it could be scored.

Question 6 (Standard/High demand)

06.1 This question discriminated well between students. About 15% scored 4 marks with 20% gaining 3 marks. The first two marking points were most commonly scored. Students who said that 'no energy was lost' as a consequence of the step-up transformer's effect did not score the third marking point.

06.2 Approximately 55% of students scored 2 marks, while 15% of students scored 1 mark. Students who scored no marks usually confused the quantity that was decreased (pd) with the quantity that increased (current). Some student answers lacked technical accuracy referring to energy, power or charge incorrectly.

06.3 Two thirds of students scored 4 marks for this calculation, whereas about 20% of students scored 3 marks. A common mistake was to try to multiply the answer by the number of seconds in a day, which would probably only score the significant figure mark if correct, as the Physics equations were applied incorrectly.
Common mistakes were to round the answer to 1 400 000 000 C, which would score 3 marks if the full s.f. answer was seen, or round the answer to 141, which would score 3 marks for the supporting calculations if seen. A common error was to miscount the number of zeroes, so would only score 3 marks.

Question 7 (Standard/High demand)

07.1 54% of students could state what an alpha particle consists of. The list principle was applied when students wrote '2 protons and 2 neutrons – a helium atom', which did not score.

07.2 65% of students completed the nuclear equation correctly, scoring 2 marks, whereas 24% scored just 1 mark.

07.3 Students generally made good attempts to answer this question and marking points 1, 2 and 4 were seen most often. To score the 5th marking point students need to make a comparative statement, internal versus external damage. The third marking point was least likely to score, as students rarely referred to dose or the living cells / tissues / organs inside the body. Some students incorrectly thought that ionisation was a process that happened to cells, rather than atoms, so often didn't score the fifth marking point for this reason. Very few students scored 5 marks and the question discriminated well between students of differing ability.

Question 8 (Standard/High demand)

08.1 About 90% of students gave the correct measuring instrument. While it wasn't seen often, an answer of a 'volumetric pipette' was also creditworthy. 'Pipette' was insufficient.

08.2 Around 90% of students correctly identified the hazard in the investigation.

08.3 For this calculation, about 45% of students scored 5 marks and 20% of students scored 4 marks. A common mistake was to calculate *L* using one of the masses given in the question, rather than the change in mass. The resulting numerical answer would score zero as the equation was not being used correctly.

08.4 About 15% of students scored 2 marks for this explanation and 10% of students scored 1 mark. Many students reached incorrect conclusions and many students simply reworded the information given in the question.

08.5 7% of students scored 2 marks and 3% of students scored 1 mark. Many students reached incorrect conclusions and many students reworded the information given in the question without adding to it.

4.7.3.4 Transformers (HT only)

Question 9 (High demand)

09.1 Approximately 55% of students scored 5 marks, but in the 2022 series students were provided with an Equations Sheet with all the equations. A commonly seen answer was 73 500, which scored 4 marks for not converting the height into metres.

09.2 5% scored 2 marks and about 30% scored 1 mark. Many students failed to score a mark by pointing to the 'inaccuracy of the measured mass / height / gravitational field strength', or referring to the measurements as being 'low resolution'. 'Mass may have been greater than 60 kg' or 'time may have been longer / shorter than 1.40 seconds' were other common incorrect answers.

09.3 About 75% of students identified the correct conclusion.

Question 10 (High demand)

10.1 About 45% of students scored 6 marks for this extended calculation, but in the 2022 series students were provided with an Equations Sheet with all the equations. Therefore, students were supported when it came to attempting this question. With an alternative approach using equations from paper 2, students' answers were marked on whichever approach brought them closest to the correct final answer. An answer of 6 m/s with no supporting working did not score full marks as students could achieve this answer by multiplying the spring constant and the extension together, which would give them the maximum force acting on the toy aeroplane.

10.2 About 65% of students scored the mark. The most common incorrect answers seen were gravitational potential or elastic potential.

10.3 Approximately 20% of students scored a mark. Many students failed to score a mark because they gave a factor without a specific change e.g. 'extension of spring', rather than 'increase the extension of the spring'.

Question 11 (High demand)

Due to incorrect Advance Information guidance being issued for this question, and to avoid students being disadvantaged, Question 11 was discounted and all students were awarded full (9) marks.

4.7.3.4 Transformers (HT only)

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account of how students have performed for each question.

Mark Ranges and Award of Grades

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