AQA GCSE Physics | 8463

SPECIFICATION POINT 4.3.1.1

Density of materials

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**20**
Available paper years	**2003–2025**

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.

4.3.1.1 Density of materials

Answer 01 · Mark scheme June 2003 | 3451H | Original Q7 | Legacy

The full source mark scheme begins on page 36. Follow original question 7 in that document.

Answer 02 · Mark scheme June 2003 | 3462H3 | Original Q5 | Legacy

The full source mark scheme begins on page 58. Follow original question 5 in that document.

4.3.1.1 Density of materials

Answer 03 · Mark scheme June 2018 | 8463/1H | Original Q10

Question	Answers	Extra information	Mark	AO/ Spec. Ref
10.1		an answer of 27 600 (kg) scores **3** marks		AO2 4.3.1.1
	$1.2 = \frac{m}{2.3 \times 10^4}$		1	
	$m = 1.2 \times 2.3 \times 10^4$		1	
	m = 27 600 (kg) **or** $m = 2.76 \times 10^4$ (kg)	allow an answer of 28 000 (kg) or 2.8×10^4 (kg)	1	
10.2		allow power output for kinetic energy throughout		AO3 4.1.1.2
	mass of air passing the turbine blades is halved which decreases kinetic energy by a factor of two		1	
	(wind speed is halved) decreasing kinetic energy by a factor of four		1	
	so kinetic energy decreases by a factor of eight		1	
10.3		an answer that rounds to 7.50 (m/s) scores **3** marks		AO2 4.1.1.2
	$388\,000 = 0.5 \times 13\,800 \times v^2$	this mark may be awarded if P is incorrectly / not converted	1	
	$v^2 = \frac{(2 \times 388\,000)}{13\,800}$	this mark may be awarded if P is incorrectly / not converted	1	
	or			
	$v^2 = \frac{388\,000}{(0.5 \times 13\,800)}$			
	or			
	$v^2 = 56.2$			
	v = 7.50 (m/s)	an answer that rounds to 7.50 (m/s) only	1	
Total			**9**	

4.3.1.1 Density of materials

Answer 04 · Mark scheme

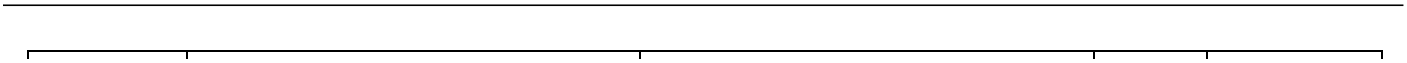
June 2018 | 8463/2H | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	all heights drawn the same as tube 1	judge by eye	1	AO2 4.5.5.1.2
04.2	increasing depth increases the height / mass / volume (of the water column) above the swimmer	allow more water above (the swimmer) more water is insufficient	1	AO1 4.5.5.1.2
	increasing the weight / force (of water) acting on the swimmer		1	
04.3		an answer of 12 112.8 scores **3** marks		
	increase in depth = 1.2 (m)		1	AO2 4.5.5.1.2
	(Δ) p = 1.2 × 1030 × 9.8	allow either 0.50 **or** 1.70 for 1.2	1	AO2 4.5.5.1.2
	(Δ) p = 12112.8	allow a correctly rounded answer allow a correct calculation using either 0.50 **or** 1.70	1	AO2 4.5.5.1.2
	pascals **or** Pa	do **not** accept pa allow N/m^2	1	AO1 4.5.5.1.2
Total			7	

4.3.1.1 Density of materials

Answer 04 · Mark scheme

June 2018 | 8463/2H | Original Q4



4.3.1.1 Density of materials

Answer 05 · Mark scheme

June 2018 | 8463/2H | Original Q10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	at least three circles drawn clockwise arrows on circles	 allow **1** mark for one or two circles with clockwise arrows	1 1	AO1 4.7.2.1
10.2	4×10^{-6}		1	AO1 4.7.2.1
10.3	the sides of the coil (parallel to the magnet) experience a force (in opposite directions) the forces cause moments that act in the same (clockwise / anticlockwise) direction **or** the moments cause the coil to rotate (clockwise / anticlockwise) (each half-revolution) the two halves of the (rotating) commutator swap from one (carbon) brush to the other (each half-revolution) the commutator reverses the current (in the coil) **or** keeping the forces in the same direction (keeping the coil rotating)	allow the current creates a magnetic field ignore Fleming's Left Hand Rule allow the magnetic fields interact to create a pair of forces (acting in opposite directions) **or** allow the magnetic fields interact causing the coil to rotate allow keeps the current in the same direction relative to the (permanent) magnetic field	1 1 1 1	AO1 4.7.2.3
Total			**7**	

4.3.1.1 Density of materials

Answer 06 · Mark scheme

June 2019 | 8463/1H | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4.1	electric car journey will take a (much) longer time (because) battery will need recharging **or** (because) the car will need to stop for 40 minutes	allow diesel car journey will take a shorter time allow diesel car will not need to be refuelled	1 1	4.1.3 AO3
4.2	energy stored in diesel = 45 × 51 = 2295 (MJ) energy stored in batteries = 0.95 × 280 = 266 (MJ) (so) the diesel stores more energy than the battery (and the diesel car has a higher range)	 this mark is dependent on correct calculations of energy stored	1 1 1	4.1.3 1AO1 1AO2 1AO3
4.3	any **2** from: • recharging is a continuous process • fewer cells needed in the car • more cars can be charged at the same time	 allow cars do not need to stop to recharge allow shorter journey times allow don't have to wait for battery to recharge allow longer time between recharges allow the range of the electric car is increased allow smaller battery needed in the car allow do not need to find a charging point allow fewer charging stations needed ignore it is quicker ignore cost of charging ignore methods of electricity generation	2	4.1.3 AO1

4.3.1.1 Density of materials

Answer 06 · Mark scheme

June 2019 | 8463/1H | Original Q4

4.4	when cars are plugged in the energy from car batteries could be transferred back to the National Grid	 allow mains supply for National Grid allow energy from car batteries could be used to power household appliances	1 1	4.1.3 AO1
Total			**9**	

4.3.1.1 Density of materials

Answer 07 · Mark scheme

June 2019 | 8463/1H | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
9.1	metre rule has a lower resolution so is less accurate (than the micrometer screw gauge)	allow metre rule has a resolution of 1mm / 1cm fewer decimal places is insufficient	1 1	WS2.3 RP5 4.3.1.1 AO1
9.2	record the value of the zero error when there is no object on the balance subtract / add the value of the zero error		1 1	RP5 4.3.1.1 AO3
9.3	$V = (18.45 \times 10^{-3})^3$ **or** $V = 0.01845^3$ $V = 6.28 \times 10^{-6}$ (m^3) $8.0 \times 10^3 = \frac{m}{6.28 \times 10^{-6}}$ $m = 8.0 \times 10^3 \times 6.28 \times 10^{-6}$ m = 0.0502 (kg)	an answer of 0.0502 (kg) scores **5** marks this mark may be awarded if width is incorrectly / not converted this answer only allow $8.0 \times 10^3 = \frac{m}{\text{their calculated V}}$ allow $m = 8.0 \times 10^3 \times$ their calculated V allow an answer consistent with their calculated V	 1 1 1 1	RP5 4.3.1.1 AO2
Total			**9**	

4.3.1.1 Density of materials

Answer 08 · Mark scheme

June 2019 | 8463/1H | Original Q11

Question 11

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.1	the (mean) kinetic energy of the particles increases	allow the (mean) speed of the particles increases 'kinetic energy increases' is insufficient by itself do not accept particles vibrating	1	4.3.2.1 AO1
	which increases the (internal) energy of the water	ignore description of evaporation	1	
11.2	Particles in a gas have more potential energy than particles in a liquid.		1	4.3.1.1 AO1
11.3	Energy given to water E = mL with quantities defined		1	4.3.3.1 AO1
	power output (of Bunsen burner) $= \frac{\text{energy transferred (to water)}}{\text{time}}$	allow $P = \frac{E}{t}$ with quantities defined	1	
	power output $= \frac{\text{change in mass} \times \text{specific latent heat}}{\text{time}}$	allow E = Pt equated with E = mL or stated in words **or** $P = \frac{mL}{t}$ with quantities defined	1	
	time should be converted to seconds **or** use a time of 300 seconds		1	
Total			**7**	

4.3.1.1 Density of materials

Answer 09 · Mark scheme

November 2020 | 8463/1H | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	density = $\frac{\text{mass}}{\text{volume}}$ **or** $\rho = \frac{m}{V}$		1	AO1 4.3.1.1
03.2	$998 = \frac{\text{m}}{6\ 500\ 000}$ m = 998 × 6 500 000 m = 6 487 000 000 m = 6.487 × 10^9 (kg)	 allow a correct conversion of their calculated value of mass into standard form	1 1 1 1	AO2 4.3.1.1
03.3	energy transferred = power × time **or** $E = Pt$		1	AO1 4.2.4.2
03.4	t = 18 000 (s) **or** t = 5 × 60 × 60 E = 1.5 × 10^9 × 18 000 E = 2.7 × 10^{13} (J)	 allow a correct substitution using an incorrectly/not converted value of t allow a correct calculation using an incorrectly/not converted value of t	1 1 1	AO2 4.2.4.2
03.5	the variation in demand is (much) greater than 1.5 × 10^9 W demand remains high for longer than 5 hours	allow the increase in demand is greater than the (power) output of the (hydroelectric) power station allow 04:00 to 16:00 is 12 hours allow 04:00 to 16:00 is greater than 5 hours	1 1	AO3 4.1.3
Total			**11**	

4.3.1.1 Density of materials

Answer 10 · Mark scheme

November 2021 | 8463/1H | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	balance / scales		1	AO1 4.3.1.1 RPA5
04.2	density = $\frac{\text{mass}}{\text{volume}}$ **or** $\rho = \frac{m}{V}$		1	AO1 4.3.1.1 RPA5
04.3	$0.68 = \frac{85}{V}$ $V = \frac{85}{0.68}$ $V = 125\ (cm^3)$		1 1 1	AO2 4.3.1.1 RPA5
04.4	repeat readings (of volume) need taking (of each fruit) to show that the readings are close together	allow ‘the same’ for ‘close together’	1	AO3 4.3.1.1 RPA5
Total			**6**	

4.3.1.1 Density of materials

Answer 11 · Mark scheme

November 2021 | 8463/2H | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	hold thumb first finger and second finger (of left hand) at right angles to each other	allow first two fingers/index and middle for first and second finger throughout	1	AO1
	second finger represents the current pointing out of the paper		1	AO1
	first finger represents the field pointing downwards		1	AO3
	thumb points in the direction of the force / thrust / acceleration		1	AO3
	(therefore) the rod moves left to right	allow correct description (eg away from the magnet) dependent on scoring marking point 3 or 4	1	AO3 4.7.2.2
09.2	decrease the resistance of the variable resistor	allow increase the current/pd	1	AO3 4.7.2.2
	use a stronger magnet	allow use a magnet with a greater flux density	1	

4.3.1.1 Density of materials

Answer 11 · Mark scheme

09.3	F = 0.30 × 1.7 × 0.050		1	AO2 4.5.6.2.2
	F = 0.0255 (N)		1	4.5.6.1.5 4.7.2.2
	m = 0.004(0 kg)		1	
	0.0255 = 0.0040 × a	this mark may be awarded if *m* is incorrectly / not converted and / or *F* is incorrectly calculated	1	
	a = 0.0255 / 0.0040 **or** a = 6.375	this mark may be awarded if *m* is incorrectly / not converted and / or *F* is incorrectly calculated	1	
	Δv = 6.375 × 0.15 = 0.95625 (m/s)	allow a correct calculation using an incorrectly / not converted *m* and / or an incorrectly calculated *F* allow 0.96 **or** 0.956 (m/s)	1	
	alternative method			
	F = 0.30 × 1.7 × 0.050 (1)			
	F = 0.0255 (N) (1)			
	m = 0.004(0 kg) (1)			
	0.0255 = $\frac{0.0040 \times \Delta v}{0.15}$ (1)	this mark may be awarded if *m* is incorrectly / not converted and / or *F* is incorrectly calculated		
	Δv = $\frac{0.0255 \times 0.15}{0.0040}$ (1)	this mark may be awarded if *m* is incorrectly / not converted and / or *F* is incorrectly calculated		
	Δv = 0.95625 (m/s) (1)	allow a correct calculation using an incorrectly / not converted *m* and / or an incorrectly calculated *F* allow 0.96 **or** 0.956 (m/s)		

Total			**13**

4.3.1.1 Density of materials

Answer 12 · Mark scheme

June 2022 | 8463/1H | Original Q2

Question 2

Question	Answers	Mark	AO / Spec. Ref.
02.1	**Level 3**: The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO1 4.3.1.1 RPA5
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content: • measure mass using a balance / scales • part fill a measuring cylinder with water and measure initial volume • place rock in water and measure final volume • volume of rock = final volume − initial volume • fill a displacement / eureka can with water level with spout • place rock in water and collect displaced water • measuring cylinder used to determine volume of displaced water • volume of rock = volume of displaced water • use mass and volume to calculate density • use of: density = $\frac{\text{mass}}{\text{volume}}$		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	maximum density = 2.65 (g/cm^3) minimum density = 2.45 (g/cm^3)	both required	1	AO3 4.3.1.1 RPA5

4.3.1.1 Density of materials

Answer 12 · Mark scheme

June 2022 | 8463/1H | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	chalk or flint		1	AO3 4.3.1.1 RPA5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	a mean can be calculated which reduces the effect of random errors	 allow anomalies can be identified / removed	1 1	AO3 4.3.1.1 RPA5

Total Question 2		10

4.3.1.1 Density of materials

Answer 13 · Mark scheme

June 2022 | 8463/1H | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	measuring cylinder	allow burette allow beaker with scale / graduations	1	AO3 4.3.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	boiling water		1	AO3 4.3.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	change in mass = 0.009 (kg)		1	AO2
	25 200 = 0.009 L	allow a correct substitution using an incorrectly calculated value of m	1	AO2
	$L = \frac{25\,200}{0.009}$	allow a correct rearrangement using an incorrectly calculated value of m	1	AO2 AO2
	$L = 2.8 \times 10^6$ or $L = 2\,800\,000$	allow a correctly calculated answer using an incorrectly calculated value of m	1	AO1 4.3.2.3
	J/kg	if a unit other than J/kg is given it must match the numerical answer	1	

4.3.1.1 Density of materials

Answer 13 · Mark scheme

June 2022 | 8463/1H | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	less energy (than 25 200 J) was transferred to the water (so) student's value of *L* was too high	 2nd mark conditional on scoring 1st mark	1 1	AO3 4.3.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	the measured change in mass is too high (for the energy supplied) (so) student's value of L is too low	allow a smaller mass of water actually changed state at boiling point 2nd mark conditional on scoring 1st mark	1 1	AO3 4.3.2.3

Total Question 8		**11**

Answer 14 · 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	

4.3.1.1 Density of materials

Answer 14 · 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**

4.3.1.1 Density of materials

Answer 15 · Mark scheme

June 2022 | 8463/2HR | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	upthrust acts (upwards on the brick) normal contact force acts upwards (on the brick) weight is equal to upthrust plus normal contact force	 allow resultant force is equal to zero only if all three forces are given	1 1 1	AO1 4.5.1.2 4.5.5.1.2

4.3.1.1 Density of materials

Answer 15 · Mark scheme

June 2022 | 8463/2HR | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	$A = 0.25 \times 0.10 = 0.025$ (m^2)		1	AO2 4.5.5.1.1 4.5.5.1.2
	$P = \frac{637}{0.025}$	allow correct substitution of incorrectly calculated value of A	1	
	$P = 25\,480$ (Pa)	allow correct calculation using an incorrectly calculated value of A to gain further marks, $P = F/A$ or an incorrect rearrangement of $P = F/A$ must have been used with the given data	1	
	$25\,480 = \underline{2.5} \times \rho \times 9.8$	allow correct substitution of incorrectly calculated value of P	1	
	$\rho = \frac{25\,480}{9.8 \times 2.5}$	allow correct rearrangement using an incorrectly calculated value of P allow use of $h = 2.6$ (m)	1	
	$\rho = 1040$ (kg/m^3)	allow correct calculation using an incorrectly calculated value of P allow use of $h = 2.6$ (m)	1	
	Alternative method			
	$A = 0.25 \times 0.10 = 0.025$ (m^2)		1	
	volume of water column (V) $= 0.025 \times 2.5$	allow use of an incorrectly calculated value of A	1	
	$V = 0.0625$ (m^3)	allow use of an incorrectly calculated value of A	1	
	$m \left(= \frac{637}{9.8}\right) = 65$ (kg)		1	
	$\rho = \frac{65}{0.0625}$	allow use of an incorrectly calculated value of V	1	
	$\rho = 1040$ (kg/m^3)	allow use of an incorrectly calculated value of V	1	

4.3.1.1 Density of materials

Answer 15 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	$F = 618 \times \frac{49.9}{2.5}$	allow calculation of density = 1008.979 (kg/m^3)	1	AO3 4.5.5.1.1 4.5.5.1.2
	$F = 12\ 335.28$		1	
	$F = 12\ 300$ (N)		1	
		allow correct rounding of an incorrectly calculated value of F		
		allow max of **2** marks if 50 m is used		

Total Question 8		12

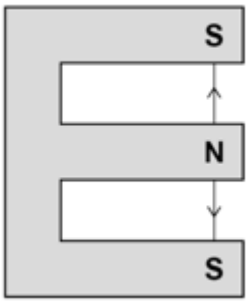
4.3.1.1 Density of materials

Answer 16 · Mark scheme

June 2023 | 8463/2H | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	current **or** potential difference	allow charge flow	1	AO1 4.7.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2			1	AO1 4.7.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	an induced magnet is a material that becomes a magnet when it is placed in a magnetic field **or** an induced magnet loses most / all of its magnetism (quickly) when removed from a magnetic field	allow 'when close to another magnet' for 'when it is placed in a magnetic field' allow 'no magnets are nearby' for 'removed from a magnetic field' 'temporary magnet' alone is insufficient	1	AO1 4.7.1.1

4.3.1.1 Density of materials

Answer 16 · Mark scheme June 2023 | 8463/2H | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	motor effect		1	AO1 4.7.2.2 4.7.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	16 mA = 0.016 A	allow 1.6×10^{-2} (A)	1	AO2 4.7.2.2
	$0.013 = B \times 0.016 \times 6.5$	allow correct substitution using incorrectly / not converted current	1	
	$B = \frac{0.013}{0.016 \times 6.5}$	allow correct re-arrangement using incorrectly / not converted current	1	
	$B = 0.125$ (T)	allow correct calculation using incorrectly / not converted current allow 0.13 (T)	1	

4.3.1.1 Density of materials

Answer 16 · Mark scheme

June 2023 | 8463/2H | Original Q4

Question	Answers	Mark	AO / Spec. Ref.
04.6	**Level 2**: Scientifically relevant features are identified; the way(s) in which they are similar / different is made clear and (where appropriate) the magnitude of the similarity / difference is noted.	3-4	AO3 4.6.1.4
	Level 1: Relevant features are identified and differences noted.	1-2	
	No relevant content	0	
	Indicative content: • for all three people, the minimum sound level that can be heard increases as frequency increases **Age** • the minimum sound level that can be heard increases with age • between 2000 and 3000 Hz the minimum sound level that can be heard increases more in **B** compared to **C** • **C** has very little variation in the minimum sound level that can be heard at all frequencies **Working in a loud environment:** • increases the minimum sound level that can be heard at all frequencies above 2000 Hz compared to working in a quiet environment • the minimum sound level that can be heard increases more as frequency increases from 2000 to 4000 Hz compared to working in a quiet environment • doesn't affect the minimum sound level that can be heard at 2000 Hz to access **level 2** the answer must include at least **one** comparison for age **and one** comparison for working in a loud environment, using supporting data/information from the graph		

Total Question 4	**12**

4.3.1.1 Density of materials

Answer 17 · Mark scheme

June 2024 | 8463/1H | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	random error		1	AO3 4.3.1.1 RPA5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	thin string would affect the volume measurement less (than thick string)	allow thin string would displace less water (than thick string) ignore absorption of water by string	1	AO3 4.3.1.1 RPA5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	the measuring cylinder could not be used to measure to 2 dp **or** the resolution of the measuring cylinder is 0.2 cm^3	allow the resolution is 0.1 cm^3 ignore the resolution is too low	1	AO3 4.3.1.1 RPA5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	subtract 0.02 g from the measured value	ignore zero the balance	1	AO3 4.3.1.1 RPA5

4.3.1.1 Density of materials

Answer 17 · Mark scheme

June 2024 | 8463/1H | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	$0.44\ cm^3 = 4.4 \times 10^{-7}\ m^3$		1	AO2 4.3.1.1 RPA5
	$21\ 500 = \frac{m}{4.4 \times 10^{-7}}$	allow a correct substitution of an incorrectly / not converted value of V	1	
	$m = 21\ 500 \times 4.4 \times 10^{-7}$	allow a correct rearrangement of an incorrectly / not converted value of V	1	
	$m = 0.00946$ (kg) **or** $m = 9.46 \times 10^{-3}$ (kg)	allow an answer consistent with an incorrectly / not converted value of V	1	

Total Question 7	**8**

4.3.1.1 Density of materials

Answer 18 · Mark scheme

June 2024 | 8463/2H | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	the height of the (column of) water above the submarine increases	allow volume / mass for height	1	AO1 4.5.5.1.2
	which increases the force / weight (of the water) acting on the submarine so pressure increases	allow $p = \rho gh$ and ρ and g remain constant so pressure increases	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	p = 110 000 000 Pa		1	AO2 4.5.5.1.2
	110 000 000 = 1026 × 9.8 × Δh	allow a correct substitution of an incorrectly / not converted value for p	1	
	$\Delta h = \frac{110\,000\,000}{1026 \times 9.8}$	allow a correct re-arrangement using an incorrectly / not converted value for p	1	
	Δh = 10 940 (m)	allow a correct calculation from using an incorrectly / not converted value for p allow 11 000 (m) if correct working shown	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	P-waves are longitudinal and S-waves are transverse		1	AO1 4.6.1.5

4.3.1.1 Density of materials

Answer 18 · Mark scheme

June 2024 | 8463/2H | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	D only P-waves can travel through liquids	 allow only P-waves can travel through the outer core allow S waves cannot travel through liquids allow S waves cannot travel through the outer core MP2 dependent on MP1	1 1	AO3 4.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	$4500 = 3.6 \times \lambda$ $\lambda = \frac{4500}{3.6}$ $\lambda = 1250$ (m)	allow a correct substitution of an incorrectly / not converted value for v allow a correct re-arrangement using an incorrectly / not converted value for v allow 1300 (m) only allow an answer consistent with a correctly converted value for v	1 1 1	AO2 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	the distance is (directly) proportional to the time between the two waves arriving (at the seismometer)	allow they are (directly) proportional allow a greater distance means a greater time for **1** mark allow there is a positive correlation for **1** mark	2	AO3 4.5.6.1.2

Total Question 4	14

4.3.1.1 Density of materials

Answer 19 · Mark scheme

June 2025 | 8463/1H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	renewable: (an energy resource that is) replenished *(*as it is used*)*	allow replaced for replenished ignore has an infinite supply ignore not running out ignore sustainable	1	AO1 4.1.3
	non-renewable: (an energy resource that is) finite	allow limited supply ignore running out ignore won't last forever	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	density = $\frac{\text{mass}}{\text{volume}}$ **or** $\rho = \frac{m}{V}$		1	AO1 4.3.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	$1030 = \frac{824\,000}{V}$		1	AO2 4.3.1.1
	$V = \frac{824\,000}{1030}$		1	
	$V = 800\ (m^3)$		1	

4.3.1.1 Density of materials

Answer 19 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	any **two** from: • at very low flow speeds there is no power output • tidal power output is (always) greater than wind power output for the same flow speeds (above 0.25 m/s) • a change in flow speed makes a bigger difference to tidal power output than wind power output • there is a non-linear relationship between flow speed and power output	allow wind power needs a higher flow speed to get the same power output (as tidal power) ignore reference to exponential relationships do **not** accept flow speed of tidal is less than flow speed of wind ignore comments about reliability or efficiency	2	AO3 4.1.3

4.3.1.1 Density of materials

Answer 19 · Mark scheme

Question	Answers	Mark	AO / Spec. Ref.
01.5	**Level 2:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	3–4	AO3 4.1.3
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content • wind turbine is much larger than the tidal turbine • wind turbine causes more visual pollution than the tidal turbine • tidal turbine is hidden from view (as it is under water) • tidal turbine is less likely to cause noise pollution (as it is under water) • wind turbine is likely to make more noise • wind turbine needs more raw materials (for construction) • more wind turbines needed for same power output (at the same flow speed) • wind turbine will harm birds, whereas tidal turbine will not • tidal turbine may harm fish, whereas wind turbine will not		

Total Question 1	12

4.3.1.1 Density of materials

Answer 20 · Mark scheme

June 2025 | 8463/2H | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	B		1	AO3 4.7.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	$F = 0.30 \times 2.0 \times 0.070$		1	AO2 4.7.2.2
	$F = 0.042$ (N)	the equation $F = BIl$ must have been used to score subsequent marks	1	
	$0.042 = 0.005 \times a$	subsequent marks may be awarded if an incorrectly / not converted mass is used	1	
	$a = \frac{0.042}{0.005}$		1	
	$a = 8.4$ (m/s^2)		1	

4.3.1.1 Density of materials

Answer 20 · Mark scheme

June 2025 | 8463/2H | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	(the interaction of) the magnetic fields produce forces on the sides of the coil (AB and CD)	do **not** accept answers describing a generator	1	AO1 4.7.2.3
	AB and CD move in opposite directions		1	
	(each half-revolution) the ends of the coil swap from one contact to the other	*allow 'split ring commutator' for ends of the coil'*	1	
	(so) current in each side of the coil is reversed, so the forces on each side of the coil are reversed		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	there is no current in the wire		1	AO1
	(so) there is no (magnetic) force acting (therefore there is no moment)	MP2 is dependent on MP1	1	AO3 4.5.1.4 4.7.2.3

Total Question 7	12

4.3.1.1 Density of materials

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme June 2003

GCSE

Physics

3451

Foundation

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Kathleen Tattersall: *Director General*

4.3.1.1 Density of materials

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

Examiners are reminded of the need to assess QoWC by the following statement appearing in the appropriate parts of the mark scheme:

The answer to this question requires ideas in good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.

The maximum marks available to a candidate whose answer is not well expressed will be (the number of marks available –1).

4.3.1.1 Density of materials

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'.

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.

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.

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

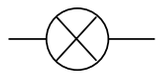
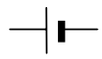
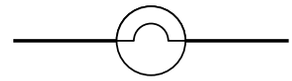
(…..) is used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.10 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.

4.3.1.1 Density of materials

3451/F Q1

question	answers	extra information	mark
(a)	circuit symbol for a lamp correct   circuit symbol for a cell correct	accept  accept any standard of drawing providing circuit would work	1 1
	2 lamps drawn in parallel with 3 cells	polarity of cells must be correct (+ to –) but cells may be either way around	1
(b)	4.5		1
(c)	the same as	accept any clear indication of the correct answer	1
total			5

4.3.1.1 Density of materials

3451/F Q2

question	answers	extra information	mark
(a)	gas		1
(b)	fuel burning stations produce electricity at any time / all the time	accept fuel available all the time	1
	wind generator can only produce when the wind is strong enough	accept it's not always windy	1
(c)	no fuel is burnt **or** no fuel is used **or** uses only energy from wind **or** does not emit harmful gases / soot / smoke	do **not** accept wind is natural / environmentally friendly / renewable answer must be in terms of wind, **not** negative of fuel burning specific examples of gases CO_2, SO_2, acid rain and greenhouse gases can be accepted ozone negates credit	1
total			4

4.3.1.1 Density of materials

3451/F Q3

question	answers	extra information	mark
(a)(i)	microwaves		1
(ii)	infra red		1
(iii)	ultrasonic		1
(b)(i)	B		1
(ii)	A		1
(c)	disturbance / vibration / movement direction	accept motion / force do **not** accept energy	1 1
(d)	sound wave	accept any clear indication of the correct answer	1
total			8

4.3.1.1 Density of materials

3451/F Q4

question	answers	extra information	mark
(a)(i)	heat		1
(ii)	temperature increases **or** (cause) convection (currents)	accept gets warmer accept gets hotter	1
(iii)	60% **or** 0.6	60 without % scores **1** mark 0.6 with a unit scores **1** mark 60 with incorrect unit scores **1** mark **or** correct substitution $\frac{120}{200}$ for **1** mark	2
(b)	street more (energy transferred as) light **or** less (energy transferred as) heat **or** useful energy output the highest	 can only score this mark if first mark scored all efficiencies calculated correctly score 2nd mark point	1 1
total			6

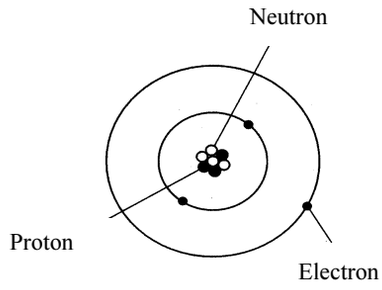
4.3.1.1 Density of materials

3451/F Q5

question	answers	extra information	mark
(a)	MN	accept 5.8, 8 seconds must include unit	1
(b)	LM	accept 0.8, 5.8 seconds must include unit	1
(c)(i)	0.8		1
(ii)	drinking alcohol		1
(d)	straight (by eye) line starting at 0.8 seconds line drawn steeper than LM starting before L	 ignore lines going beyond 2 seconds but line must exceed 2.5 metres per second before terminating	1 1
total			6

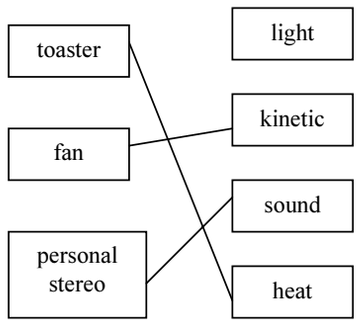
4.3.1.1 Density of materials

3451/F Q6

question	answers	extra information	mark
(a)(i)	each correct label scores 1 mark  		3
(ii)	neutron		1
(iii)	7 number of protons and neutrons **or** number of nucleons **or** number of particles in the nucleus	 accept number of particles in the centre only if first answer = 7	1 1
(b)(i)	50 ± 5		1
(ii)	50 ± 5	accept their (b)(i)	1
(iii)	less	accept any way of indicating the correct answer	1
total			9

4.3.1.1 Density of materials

3451/F Q7

question	answers	extra information	mark
(a)	each correct line scores 1 mark  	if more than 3 lines are drawn mark incorrect ones first, to a maximum of 3 lines	3
(b)	toaster	accept 1.2 kW	1
(c)(i)	400		1
(ii)	£24 **or** 2400p	full credit for their (c)(i) × 6p for full credit the correct numerical answer must have the correct unit an answer of 24 or 2400 with no unit or the incorrect unit scores **1** mark (c)(i) × 6 incorrectly evaluated scores **1** mark	2
(d)	6	allow 6000 for **1** mark allow 3 × 2 for **1** mark	2
total			9

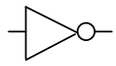
4.3.1.1 Density of materials

3451/F Q8

question	answers	extra information	mark
(a)(i)	point where the rays cross	do not credit if ambiguous	1
(ii)	converging (lens)	do **not** accept convex	1
(b)(i)	point where the rays appear to diverge from	this should appear to be within 10mm in front of the back of the arrows on the approximate centre line need not be accurately constructed using a ruler	1
(ii)	diverging (lens)	do **not** accept concave	1
(c)	converging film smaller than nearer to	accept any clear indication of the correct response e.g. ticking, ringing, writing in after a mistake	1 1 1 1
(d)(i)	(image) bigger than object / enlarge	accept just 'made bigger'	1
(ii)	it / real image can be put on a screen **or** real image on the opposite side of the lens to the object	accept 'not an imaginary or virtual image' assume 'it' refers to a real image do **not** credit 'it can be seen'	1
(e)	**either** (the converging lens is) thick in the middle thin(ner) at the edge **or** (both) sides bend outwards (1) in the middle (1) **or** one side bends in the middle (1) more than the other side bends inwards (in the middle) (1)	thickest in the middle gains **2** marks convex gains **2** marks suitable diagrams gains **2** marks	1 1
total			12

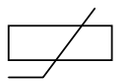
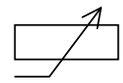
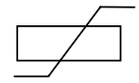
4.3.1.1 Density of materials

3451/F Q9

question	answers	extra information	mark
(a)(i)	off off on	all correct	1
(ii)	AND (gate)	accept and (gate)	1
(iii)	on on on	all correct	1
(iv)	OR (gate)	accept or (gate)	1
(b)(i)	1 0 **or** 0 1 0 1 1 0	do **not** credit on / off responses	1
(ii)		accept mirror image accept  accept with either or both parts shaded accept line through as shading	1
(c)		accept off for 0 and on for 1 throughout	
	0 0	both correct	1
	0 1	both correct	1
	1 1	both correct	1
	1 1	both correct	1

4.3.1.1 Density of materials

3451/F Q9 continued

(d)(i)		accept mirror image **or** inverted do **not** credit  **or**  or similar	1
(ii)	resistance decreases / increases / changes current (through it) increases / decreases / changes **or** temperature changes / increases / decreases (1) resistance changes / decreases / increases (1) (NTC thermistor) both marks independent but must be compatible to score **2** marks	accept 'voltage across it decreases' for **2** marks but only if it is made clear that this refers to a thermistor in series	1 1
total			13

4.3.1.1 Density of materials

3451/F Q10

question	answers	extra information	mark
(a)(i)	friction	accept any way of indicating the correct answer	1
(ii)	gravity	accept any way of indicating the correct answer	1
(b)(i)	accelerates **or** speed / velocity increases	accept faster and faster (**1** mark) do **not** accept faster pace / falls faster or suggestions of a greater but constant speed	1
	downwards / falls	accept towards the Earth / ground this may score in part (b)(ii) if it does not score here and there is no contradiction between the two parts	1
(ii)	constant speed / velocity **or** terminal velocity / speed **or** zero acceleration	stays in the same place negates credit	1
total			5

4.3.1.1 Density of materials

3451/F Q11

question	answers	extra information	mark
(a)(i)	X – mantle		1
	Y – inner core	do **not** accept solid core	1
(ii)	different to the crust **or** contains a lot of (heavy) metals	accept iron and nickel for metals	1
	higher (average) density **or** denser	density higher than 5500 (kg/m^3) gets **2** marks	1
(b)	animals were able to move from one continent to the other		1
	(when bridge broke) animals evolved differently	accept animals adapted differently	1
(c)(i)	earthquakes occur at the boundary between plates **or** earthquakes occur where plates push against each other		1
	there are no plate boundaries running through Britain	accept Britain is not near the edge of a plate	1
(ii)	convection currents (in the mantle) **or** heat released by (natural) radioactive processes		1
total			9

4.3.1.1 Density of materials

3451/F Q12

question	answers	extra information	mark
(a)(i)	outside the Earth **or** not from the Earth	accept alien accept life from / on another planet / space accept our planet for Earth	1
(ii)	radio telescope(s)	do **not** accept telescopes do **not** accept satellite dishes do **not** accept radio receivers **or** transmitters	1
(b)(i)	galaxies	do **not** accept stars	1
(ii)	any **one** from: the pulses were regular pulses from space are usually random (scientists) thought technology had been used to produce the pulses neutron stars were unknown signals from a single point	 accept signals / beats for pulses accept noise for random pulses idea of regular but not continuous	1
(iii)	neutron star is (the matter / mass) left behind after a star / red giant explodes (as a super nova)	 accept after a super nova (explosion) neutron star causing super nova gets no credit	1 1
(c)(i)	carried on the balloon / equipment	accept carried by a rocket / aircraft / satellite birds negates credit	1
(ii)	on comets or meteors	accept meteorites / shooting stars accept returning space craft accept solar wind ignore asteroids accept ufo do **not** accept solar flares do **not** accept satellites	1
total			8

4.3.1.1 Density of materials

3451/F Q13

question	answers	extra information	mark
(a)	silver is a (good) reflector of <u>heat</u> (radiation) **or** silver reflects the heat (radiation)	fact heat = infra red ignore references to light accept shiny for silver good radiator negates the mark ignore references to good conductor do **not** accept bounce back	1
	less heat is lost through the board **or** more heat is retained by the shirt	explanation accept both sides of shirt heated reflects heat back up gets **1** mark only ignore mention of friction	1
(b)	metal soleplate	accept soleplate / bottom / metal do **not** accept outside / case	1
(c)	plastic **or** rubber	accept any named plastic do **not** accept wood	1
	it is a (good) insulator **or** it is a poor conductor	ignore mention of heat if in conjunction with electricity	1
(d)	**Quality of written communication** *The answer to this question requires ideas in good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.*	*Maximum of **2** marks if ideas not well expressed.*	
	pulls iron bolt down **or** attracts the iron bolt **or** moves bolt out of plunger	answers in terms of charges attracting or repelling gain no credit	1
	plunger pushed / moved to the right (by spring) **or** plunger released		1
	push switch opens / goes to off / goes to right	accept circuit is broken for maximum credit the points must follow a logical sequence 3 correct points but incorrect sequence scores **2** marks only ignore reset action	1
total			8

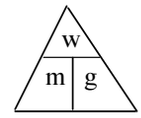
4.3.1.1 Density of materials

3451/F Q14

question	answers	extra information	mark
(a)(i)	any **one** from: the ground the air radon (gas) building materials buildings rocks / granite food cosmic rays **or** solar rays X-rays nuclear weapons testing nuclear power stations / accidents	 do **not** accept mobile phones accept from outer space accept sun but **not** sunlight accept medical uses	1
(ii)	2	allow $\frac{1200}{60\times10}$ **or** $\frac{1200}{600}$ **or** 120 for **1** mark	2
(b)	 alpha: the count rate is (greatly) reduced by the card **or** the card absorbs alphas but not betas beta: the count rate is (greatly) reduced by the metal **or** the thin metal absorbs alphas and betas **or** the thin metal absorbs all of the radiation (from the source) gamma: would pass through the thin metal but count rate is background **or** no radiation passing through **or** a higher reading would be recorded **or** to reduce the count to 2 would require much more than 3 mm of metal	answers must be comparative accept converse answers throughout accept paper for the card accept aluminium for the metal accept aluminium for the metal accept lead / aluminium for the metal	 1 1 1
total			6

4.3.1.1 Density of materials

3451/F Q15

question	answers	extra information	mark
(a)(i)	weight = mass × g.f.s.	accept w = m × g accept gravity for gfs accept  provided subsequent use of Δ correct do **not** accept N = kg × N/kg	1
(ii)	675	75 × 9 for **1** mark	2
(iii)	g.(f.s.) is higher (on Earth than Venus)	accept gravity for g.f.s. do **not** accept g.f.s. is lower unless answer states on Venus	1
(iv)	orbit time for Jupiter is <u>longer</u> / longest (than for the other planets)	do **not** give any credit for an answer that includes a comparison of diameter **or** a comparison of g.f.s.	1
(b)	**Quality of written communication** *The answer to this question requires ideas in good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.* any **two** from: dust <u>and</u> gas **or** remnants of a super nova pulled together by (force of) <u>gravity</u> nuclear fusion starts	*Maximum of **1** mark if ideas not well expressed.* accept hydrogen for dust and gas do **not** accept hydrogen burns although candidates may include more detail these points are essential to score the credit	2
total			7

4.3.1.1 Density of materials

3451/F Q16

question	answers	extra information	mark
(a)(i)	upright with the contacts at the bottom and still in place and unbent	no need for labels but incorrect label(s) cancel the mark accept a freehand drawing no need for details such as correct dimensions	1
	one blob of mercury touching <u>both</u> contacts	do **not** award mark if contacts bent to touch	1
(b)(i)	(X is a) battery	do **not** credit cell accept (set of) cells accept power supply do **not** accept power pack	1
	(Y is a) LED	**or** light emitting diode	1
(ii)	longer (time)	do **not** accept 'slower time'	1
(iii)	any **two** from: current less (so) rate of flow of charge less **or** less coulombs per second (so) discharge is slower	 do **not** accept current slower accept capacitor has charge for longer **or** charge lasts longer **or** (so total of) electrons take longer to travel round circuit	2
(c)	4200	translation correct (= 4000) but percentage addition incorrect gains **1** mark translation incorrect but 5% addition is correct gains **1** mark accept 422.1 **or** 42.2 **or** 6.3 for **1** mark	2
	ohms **or** Ω	4.2 kilohms **or** 4.2 kΩ gains all **3** marks	1
total			10

4.3.1.1 Density of materials

3451/F Q17

question	answers	extra information	mark
(a)	point at which its mass (seems to) act **or** point at which gravity (seems to) act	accept …its weight acts accept correct statements if the intent is clear e.g. … if suspended, the centre of gravity will be directly under the point of suspension e.g. … (if the object is symmetrical), the centre of gravity is on the **or** an axis (of symmetry) do **not** credit just 'it is a point'	1
(b)	**Quality of written communication** *The answer to this question requires good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.* any **five** from: clamp (steel) rod (horizontally) hang plastic / sheet by rod through (one) hole hang plumb line from rod mark ends of plumb line on the sheet and use the ruler to draw a straight line repeat with other hole centre of mass is where the lines cross check by balancing at this point	*maximum of **4** marks if ideas not well expressed* **no** marks if method quite unworkable maximum of **3** marks if no 'repeat with other hole'	5
(c)(i)	(turning) effect **or** moment force distance	all three correct accept weight accept length	1
(ii)	17.6 Nm **or** newton metre(s)	allow 44 × 0.4 **or** 0.4 × 44 for **1** mark do **not** accept N/m **or** N/cm 1760 Ncm gains all **3** marks	2 1
total			10

4.3.1.1 Density of materials

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme June 2003

GCSE

Science: Double Award Co-ordinated

3462

Paper 3F

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Kathleen Tattersall: *Director General*

4.3.1.1 Density of materials

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

Examiners are reminded of the need to assess QoWC by the following statement appearing in the appropriate parts of the mark scheme:

The answer to this question requires ideas in good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.

The maximum marks available to a candidate whose answer is not well expressed will be (the number of marks available –1).

4.3.1.1 Density of materials

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'.

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.

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.

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.

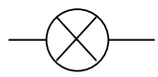
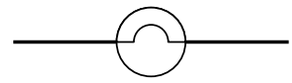
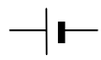
3.10 Unexpected Correct Answers not in the Mark Scheme

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.

4.3.1.1 Density of materials

Double Award
Foundation Tier 3462/3F

3462/3F Q1

question	answers	extra information	mark
(a)	circuit symbol for a lamp correct 	accept  accept any standard of drawing providing circuit would work	1
	circuit symbol for a cell correct 		1
	2 lamps drawn in parallel with 3 cells	polarity of cells must be correct (+ to –) but cells may be either way around	1
(b)	4.5		1
(c)	the same as	accept any clear indication of the correct answer	1
total			5

4.3.1.1 Density of materials

3462/3F Q2

question	answers	extra information	mark
(a)	gas		1
(b)	fuel burning stations produce electricity at any time / all the time	accept fuel available all the time	1
	wind generator can only produce when the wind is strong enough	accept it's not always windy	1
(c)	no fuel is burnt **or** no fuel is used **or** uses only energy from wind **or** does not emit harmful gases / soot / smoke	do **not** accept wind is natural / environmentally friendly / renewable answer must be in terms of wind, **not** negative of fuel burning specific examples of gases CO_2, SO_2, acid rain and greenhouse gases can be accepted ozone negates credit	1
total			4

4.3.1.1 Density of materials

3462/3F Q3

question	answers	extra information	mark
(a)(i)	microwaves		1
(ii)	infra red		1
(iii)	ultrasonic		1
(b)(i)	B		1
(ii)	A		1
(c)	disturbance / vibration / movement direction	accept motion / force do **not** accept energy	1 1
(d)	sound wave	accept any clear indication of the correct answer	1
total			8

4.3.1.1 Density of materials

3462/3F Q4

question	answers	extra information	mark
(a)(i)	heat		1
(ii)	temperature increases **or** (cause) convection (currents)	accept gets warmer accept gets hotter	1
(iii)	60% **or** 0.6	60 without % scores **1** mark 0.6 with a unit scores **1** mark 60 with incorrect unit scores **1** mark **or** correct substitution $\frac{120}{200}$ for **1** mark	2
(b)	street more (energy transferred as) light **or** less (energy transferred as) heat **or** useful energy output the highest	 can only score this mark if first mark scored all efficiencies calculated correctly score 2nd mark point	1 1
total			6

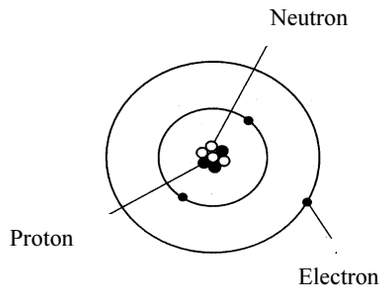
4.3.1.1 Density of materials

3462/3F Q5

question	answers	extra information	mark
(a)	MN	accept 5.8, 8 seconds must include unit	1
(b)	LM	accept 0.8, 5.8 seconds must include unit	1
(c)(i)	0.8		1
(ii)	drinking alcohol		1
(d)	straight (by eye) line starting at 0.8 seconds line drawn steeper than LM starting before L	 ignore lines going beyond 2 seconds but line must exceed 2.5 metres per second before terminating	1 1
total			6

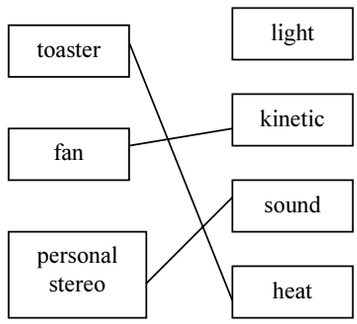
4.3.1.1 Density of materials

3462/3F Q6

question	answers	extra information	mark
(a)(i)	each correct label scores 1 mark  		3
(ii)	neutron		1
(iii)	7 number of protons and neutrons **or** number of nucleons **or** number of particles in the nucleus	 accept number of particles in the centre only if first answer = 7	1 1
(b)(i)	50 ± 5		1
(ii)	50 ± 5	accept their (b)(i)	1
(iii)	less	accept any way of indicating the correct answer	1
total			9

4.3.1.1 Density of materials

3462/3F Q7

question	answers	extra information	mark
(a)	each correct line scores 1 mark  	if more than 3 lines are drawn mark incorrect ones first, to a maximum of 3 lines	3
(b)	toaster	accept 1.2 kW	1
(c)(i)	400		1
(ii)	£24 **or** 2400p	full credit for their (c)(i) × 6p for full credit the correct numerical answer must have the correct unit an answer of 24 or 2400 with no unit or the incorrect unit scores **1** mark (c)(i) × 6 incorrectly evaluated scores **1** mark	2
(d)	6	allow 6000 for **1** mark allow 3 × 2 for **1** mark	2
total			9

4.3.1.1 Density of materials

3462/3F Q8

question	answers	extra information	mark
(a)(i)	friction	accept any way of indicating the correct answer	1
(ii)	gravity	accept any way of indicating the correct answer	1
(b)(i)	accelerates **or** speed / velocity increases	accept faster and faster (**1** mark) do **not** accept faster pace / falls faster or suggestions of a greater but constant speed	1
	downwards / falls	accept towards the Earth / ground this may score in part (b)(ii) if it does not score here and there is no contradiction between the two parts	1
(ii)	constant speed / velocity **or** terminal velocity / speed **or** zero acceleration	stays in the same place negates credit	1
total			5

4.3.1.1 Density of materials

3462/3F Q9

question	answers	extra information	mark
(a)(i)	X – mantle		1
	Y – inner core	do **not** accept solid core	1
(ii)	different to the crust **or** contains a lot of (heavy) metals	accept iron and nickel for metals	1
	higher (average) density **or** denser	density higher than 5500 (kg/m^3) gets **2** marks	1
(b)	animals were able to move from one continent to the other		1
	(when bridge broke) animals evolved differently	accept animals adapted differently	1
(c)(i)	earthquakes occur at the boundary between plates **or** earthquakes occur where plates push against each other		1
	there are no plate boundaries running through Britain	accept Britain is not near the edge of a plate	1
(ii)	convection currents (in the mantle) **or** heat released by (natural) radioactive processes		1
total			9

4.3.1.1 Density of materials

3462/3F Q10

question	answers	extra information	mark
(a)(i)	outside the Earth **or** not from the Earth	accept alien accept life from / on another planet / space accept our planet for Earth	1
(ii)	radio telescope(s)	do **not** accept telescopes do **not** accept satellite dishes do **not** accept radio receivers **or** transmitters	1
(b)(i)	galaxies	do **not** accept stars	1
(ii)	any **one** from: the pulses were regular pulses from space are usually random (scientists) thought technology had been used to produce the pulses neutron stars were unknown signals from a single point	 accept signals / beats for pulses accept noise for random pulses idea of regular but not continuous	1
(iii)	neutron star is (the matter / mass) left behind after a star / red giant explodes (as a super nova)	 accept after a super nova (explosion) neutron star causing super nova gets no credit	1 1
(c)(i)	carried on the balloon / equipment	accept carried by a rocket / aircraft / satellite birds negates credit	1
(ii)	on comets or meteors	accept meteorites / shooting stars accept returning space craft accept solar wind ignore asteroids accept ufo do **not** accept solar flares do **not** accept satellites	1
total			8

4.3.1.1 Density of materials

3462/3F Q11

question	answers	extra information	mark
(a)	silver is a (good) reflector of heat (radiation) **or** silver reflects the heat (radiation)	fact heat = infra red ignore references to light accept shiny for silver good radiator negates the mark ignore references to good conductor do **not** accept bounce back	1
	less heat is lost through the board **or** more heat is retained by the shirt	explanation accept both sides of shirt heated reflects heat back up gets **1** mark only ignore mention of friction	1
(b)	metal soleplate	accept soleplate / bottom / metal do **not** accept outside / case	1
(c)	plastic **or** rubber	accept any named plastic do **not** accept wood	1
	it is a (good) insulator **or** it is a poor conductor	ignore mention of heat if in conjunction with electricity	1
(d)	**Quality of written communication** *The answer to this question requires ideas in good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.*	*Maximum of **2** marks if ideas not well expressed.*	
	pulls iron bolt down **or** attracts the iron bolt **or** moves bolt out of plunger	answers in terms of charges attracting or repelling gain no credit	1
	plunger pushed / moved to the right (by spring) **or** plunger released		1
	push switch opens / goes to off / goes to right	accept circuit is broken for maximum credit the points must follow a logical sequence 3 correct points but incorrect sequence scores **2** marks only ignore reset action	1
total			8

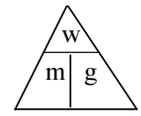
4.3.1.1 Density of materials

3462/3F Q12

question	answers	extra information	mark
(a)(i)	any **one** from: the ground the air radon (gas) building materials buildings rocks / granite food cosmic rays **or** solar rays X-rays nuclear weapons testing nuclear power stations / accidents	 do **not** accept mobile phones accept from outer space accept sun but **not** sunlight accept medical uses	1
(ii)	2	allow $\frac{1200}{60\times10}$ **or** $\frac{1200}{600}$ **or** 120 for **1** mark	2
(b)	 alpha: the count rate is (greatly) reduced by the card **or** the card absorbs alphas but not betas beta: the count rate is (greatly) reduced by the metal **or** the thin metal absorbs alphas and betas **or** the thin metal absorbs all of the radiation (from the source) gamma: would pass through the thin metal but count rate is background **or** no radiation passing through **or** a higher reading would be recorded **or** to reduce the count to 2 would require much more than 3 mm of metal	answers must be comparative accept converse answers throughout accept paper for the card accept aluminium for the metal accept aluminium for the metal accept lead / aluminium for the metal	 1 1 1
total			6

4.3.1.1 Density of materials

3462/3F Q13

question	answers	extra information	mark
(a)(i)	weight = mass × g.f.s.	accept w = m × g accept gravity for gfs accept  provided subsequent use of Δ correct do **not** accept N = kg × N/kg	1
(ii)	675	75 × 9 for **1** mark	2
(iii)	g.(f.s.) is higher (on Earth than Venus)	accept gravity for g.f.s. do **not** accept g.f.s. is lower unless answer states on Venus	1
(iv)	orbit time for Jupiter is <u>longer</u> / longest (than for the other planets)	do **not** give any credit for an answer that includes a comparison of diameter **or** a comparison of g.f.s.	1
(b)	**Quality of written communication** *The answer to this question requires ideas in good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.* any **two** from: dust <u>and</u> gas **or** remnants of a super nova pulled together by (force of) <u>gravity</u> nuclear fusion starts	*Maximum of **1** mark if ideas not well expressed.* accept hydrogen for dust and gas do **not** accept hydrogen burns although candidates may include more detail these points are essential to score the credit	2
total			7

4.3.1.1 Density of materials

Answer 04 · Examiner comments

June 2018 | 8463/2H | Original Q4

Question 4 (Standard and Standard/high demand)

04.1 Less than 50% of the students realised that the shape of the container makes no difference to the liquid level and that the level in each tube would be the same.

04.2 Many students were able to give a statement matching the first mark point, but few were then able to relate the increase in pressure to an increase in force to score the second mark.

04.3 This question was well done with nearly 90% of the students calculating a correct numerical answer. However only 50% knew the unit for pressure.

4.3.1.1 Density of materials

Answer 05 · Examiner comments

June 2018 | 8463/2H | Original Q10

Question 10 (Standard/high and High demand)

10.1 Many diagrams looked like the field around a bar magnet or solenoid. Shapes similar to the electric field around a point charge were also drawn.

10.2 About half of students knew the value equivalent to 4 microtesla.

10.3 Very few students gave a coherent, detailed answer to this question. Most concentrated on what made the coil move, although ideas were not always expressed with clarity. It was unusual to see an answer that considered moments. The action of the commutator was not understood well and its function was often not mentioned. Some students appreciated that current direction needed to be reversed but thought an alternating current was the solution. There were significant numbers of students unsure whether the question was about an electric motor or a generator. Many answers made reference to induced currents in the coil and the coil cutting field lines to induce a potential difference.

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on 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.

4.3.1.1 Density of materials

Answer 09 · Examiner comments

November 2020 | 8463/1H | Original Q3

Question 3 (Standard demand)

03.1 91% of students answered this question correctly. The equation was acceptable using symbols or words. Students should be encouraged not to give multiple answers due to the list principle being applied: right + wrong = 0 marks. eg ρ = m/V and m = ρ /V would score zero.

03.2 78% of students scored 4 marks. Most students who knew the equation were able to perform the calculation correctly. A significant number made transcription errors, eg putting the density as 988 kg / m^3 instead of 998 or adding / subtracting a 0 to the given volume. The majority of students were able to express their answer in standard form, even if their calculation was incorrect,.

03.3 85% of students answered this question correctly. The equation was acceptable using symbols or words. Students should be encouraged not to give multiple answers due to the list principle being applied: right + wrong = 0 marks. eg E = Pt and P = t/E would score zero.

03.4 59% of students scored 3 marks. Some students struggled to convert 5 hours into seconds, converting it into minutes instead. A correct calculation using minutes instead of seconds would score 2 marks.

03.5 Only 4% of students scored 2 marks, while 43% of students scored 1 mark. Many students failed to realise that they needed to take data from the graph and compare it with the stated output from the hydroelectric power station. Instead, they gave explanations in terms of people using more energy during the day and / or weather conditions affecting the supply of water. In many cases, despite the diagram showing the power station with a brief explanation of how it works, students referred to unreliable waves and wind, or varying tides. Of the students who took information from the graph, the most common answer was comparing the times involved. Although some students compared the peak demand with the power station output, not many referred to the increase in the demand, which was the relevant point.

4.3.1.1 Density of materials

Answer 10 · Examiner comments November 2021 | 8463/1H | Original Q4

Question 4

Question **04.1** was poorly answered with many incorrect answers seen. A common incorrect answer was ‘scale’, as opposed to ‘scales’. Since all measuring instruments have a scale, this answer did not score. Students should be encouraged to not give multiple answers, as was common here, as examiners apply the ‘list principle’ when this happens. Questions **04.2** and **04.3** were well answered, but students found **04.4** difficult with most students not understanding that ‘precision’ refers to the spread of repeat readings, rather than the resolution of an instrument or its accuracy.

4.3.1.1 Density of materials

Answer 11 · Examiner comments

November 2021 | 8463/2H | Original Q9

Question 9

Whilst many of the students could quote Fleming's Left Hand rule, few were able to apply it in order to explain how to predict the direction of the copper rod given in Figure 16. In part **09.2** an answer 'bigger magnet' is not necessarily the same as a 'stronger magnet' and neither is 'changing the current' necessarily the same as 'increasing the current'. In part **09.3** whilst there were few answers scoring all six marks many of the students gained partial credit by showing their working out clearly. A very common error was not to convert 4 g to kg.

Concluding Remarks

The paper presented to the students was broadly similar to that seen in previous series. Many of the errors made by the students were similar to those seen in previous series.

The failure to be able to accurately present information requiring recall from the specification (AO1), for example understanding the term 'elastically deformed' or describing the difference between a transverse wave and a longitudinal wave was commonly seen. Incorrect recall of equations stopped many students from scoring marks in calculations. Students often seemed to be unsure what the command word in a question meant. For example being asked to 'Explain' an application of Fleming's Left Hand rule is not the same as 'Describe'.

Areas of the specification that were particularly poorly answered were sections 4.7 (Magnetism and Electromagnetism), 4.8 (Space physics) and 4.6.2.5 (Lenses). Vector diagrams did not appear to be well understood.

Many of the students now understand the importance of showing clear working out when completing a calculation. This is crucial in the more complex calculations.

Similar to previous series a significant number of the students were unable to read values from graphs accurately and failed to realise when numerical values were not given in standard SI units.

4.3.1.1 Density of materials

Answer 11 · 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.

4.3.1.1 Density of materials

Answer 12 · Examiner comments June 2022 | 8463/1H | Original Q2

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.

Answer 16 · Examiner comments June 2023 | 8463/2H | Original Q4

04.1

31% of students gained this mark. Many students responded with a selection of random Physics terms.

04.2

74% of students recognised the direction of the magnetic field.

4.3.1.1 Density of materials

Answer 16 · Examiner comments June 2023 | 8463/2H | Original Q4

04.3

51% of students knew what an induced magnet is. Responses sometimes confused magnets and magnetic materials. Most correct answers were to do with placing a material into a field to become a magnet, compared with removing the material from the field.

04.4

88% of students knew that it is the motor effect that causes the coil to move..

04.5

46% of students scored all 4 marks for this calculation. There were a wide variety of incorrect conversions of mA, which gained 3 out of the 4 marks.

04.6

Most students were able to make generic statements about how age and environment affect hearing. 35% of students were able to use the data in the graph to support their statements. Some responses just gave information about person A, B and C, without any comparisons. Students did not use the patterns in the graph to back up conclusions. There was some confusion over sensitivity, and a number tried to explain the variables to the extent that the response became incorrect. Examples of this included saying that a higher minimum sound level shows better hearing.
A proportion of the responses mentioned ideas about being "used to a loud sound" so "could hear loud sounds better" and younger people not having had the experience of a full range of frequencies due to their age. Alternatively, the idea that being in a quiet environment means you can only hear quiet sounds was another misunderstanding which was often seen.

Answer 17 · Examiner comments June 2024 | 8463/1H | Original Q7

Question 7 (Standard/High Demand)

07.1 52% of students scored this mark. The question states that the student's eye is not in line with the level of the water. The position of the eye is likely to remain in the same (incorrect) position as the water level changes when the ring is inserted. This will cause a random error as both volume measurements will be incorrect, but not by the same amount.

07.2 63% of students scored this mark. Additional mass or absorbing extra water were ignored. The answer needed to make a comparison, rather than just state that 'volume of string affects the measurement of volume.'

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4.3.1.1 Density of materials

Answer 17 · Examiner comments June 2024 | 8463/1H | Original Q7

07.3 33% of students scored the mark for this question about resolution. Comments on low / high resolution were insufficient to score. Statements needed to refer to the resolution value itself or the number of decimal places the measurement could be read to. As measuring cylinders often have large gaps between markings, a statement that the resolution was 0.1 cm^3 was allowed.

07.4 71% of students scored a mark for this question about zero error. Common incorrect answers said, 'take repeat readings and calculate a mean.'

07.5 A grade 6-7 calculation question, but the unit conversion made this question more difficult than other similar calculations in the exam, with only 33% of students scoring all 4 marks. 57% of students scored 3 marks.

Answer 18 · Examiner comments June 2024 | 8463/2H | Original Q4

04.1
This question asked students to explain the effect of increasing depth on the pressure on a submarine. A common error was repeating the question stem "as depth increases" rather than referring to increasing height (volume or mass) of water above the submarine.

04.2
Quite a well answered question with over 72% of students gaining all 4 marks for calculating the depth of the Mariana Trench. Another 20% did not convert the pressure, or converted incorrectly.

04.3
75% of students knew what types of waves P and S-waves are.

04.4
68% of students selected the position where only P-waves are detected following an earthquake. However, the reasons often referred to "it was in a straight line" or "it was below the earthquake". A number of students just referred to the core without specifying the inner or outer core. Others confused which layers are liquid and which are solid, even though this information was given in the diagram.

04.5
95% of students gained at least 2 marks in this calculation of wavelength. Converting was sometimes unclear, often being done at the end rather than the beginning of the working, preventing students gaining all 3 marks. .

04.6
This question was about the relationship between the distance an earthquake is from a seismometer, and the time difference between P and S-waves arriving at it. 15% of students gained both marks and 30% gained 1 mark. Those who didn't score had misunderstood the question stem. A small number had identified that greater distance meant a greater time difference, but then called this inversely proportional.

4.3.1.1 Density of materials

Answer 20 · Examiner comments June 2025 | 8463/2H | Original Q7

7.1

Just over 60% of the students were able to use Flemings Left Hand rule to work out which direction the copper rod would accelerate.

7.2

Just over half of the students scored all the marks on this multi-step calculation of acceleration. Those students not scoring full marks often failed to convert the mass correctly or did not rearrange the equation F=ma correctly.

7.3

This motor question was targeted at the most able students and proved very challenging. Only about one third of the students scored any marks at all. Only a very few of the students scored four marks. Most of the students who scored any marks were most likely to gain the 2nd and/or 3rd mark points. A significant number of the students confused motors with generators.

7.4

Another poorly answered high demand question. Many answers were to do with the coil being parallel to the field and there being no force. The majority of the students had missed that there would be no current flowing at that point due to the position of the coil. If this marking point was scored, responses usually continued to the idea of there being no forces acting. The 2nd mark point was dependent on the students scoring the 1st mark point.

4.3.1.1 Density of materials

AQA

GCSE
PHYSICS

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

8463
June 2022

Version: 1.0

4.3.1.1 Density of materials

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4.3.1.1 Density of materials

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.

4.3.1.1 Density of materials

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.

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.

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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.

4.3.1.1 Density of materials

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.

4.3.1.1 Density of materials

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.

4.3.1.1 Density of materials

Questions matter

GCSE
Physics
8463/1H

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4.3.1.1 Density of materials

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General

Grade 4-5 calculation questions ask for students to recall an equation first before using it in a subsequent calculation, however in the 2025 series, students were provided with all of the equations on the Physics Equations Sheet. Subsequently, the performance on all calculations has improved compared with years when equations have needed to be recalled from memory.

The grade 8-9 multistep calculations, question **09.2** and **10.1**, were well attempted with many students scoring full marks. Question **09.2** had nearly three quarters of the students scoring 6 marks, while question **10.1** had almost 60 % of the students scoring 6 marks.

Question **02.2** was well attempted and students who had carried out the specific heat capacity required practical would have had an advantage over those who had not. For this question, just fewer than 40% of the students scored 5 or 6 marks and a further 46% of the students scored 3 or 4 marks.

Handwriting continues to be a problem for a number of students, making it very difficult for examiners to read what has been written. An increasing number of students are using computers to word process their answers for extended response questions, which is helpful for examiners in awarding credit for student responses. However, students must use the question number as printed in the question paper e.g. 04.3 rather than 4(c) to ensure that their work is matched and marked with the corresponding question part.

Many students did not cross out the work they did not want to be marked. This results in the 'list principle' being applied which means if there are two sets of working or answers and they conflict, the student scores zero.

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.

01.1

Common answers which were insufficient included 'running out', 'not running out', 'sustainable', 'not sustainable'. The specification uses the word 'replenished' so words equivalent to this were needed, so 'replaced' or 'more of the energy resource is produced' were just able to score a mark. For non-renewable the idea that the resource is finite, or there is a limited amount was needed to score the mark. It was not enough to just state the exact

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opposite of the renewable energy resources mark point. Just fewer than 20 % of the students scored 2 marks, while just over 50 % of the students scored 1 mark.

01.2

Almost all of the students scored this mark for writing down the equation linking density, mass and volume using the equation sheet provided in this exam series.

01.3

The vast majority of the students scored 3 marks for this grade 4-5 calculation of mass using the density equation.

01.4

This question was poorly answered with fewer than 10 % of the students scoring 2 marks. About 30 % of the students scored 1 mark. Students who said that tidal power output was greater than wind power did not score a mark without reference to a particular flow speed. If wind flow speed was a consistent 2 m/s and tidal flow speed never reached 0.75 m/s the wind turbine's power output would be greater.

01.5

A good range of environmental impacts were described by many students. To score within level 2, students needed to make at least one comparative statement about a factor for both turbines. The simplest way of doing this was to compare relative size.
An answer; 'The wind turbine is larger, but harms birds. The tidal turbine harms fish but does not cause visual pollution' would score 4 marks.
Nearly all of the students scored some marks with nearly 50% scoring 3 or 4 marks.

02.1

Answers such as 'electrical devices near water' were insufficient, as was 'wires in the water'. A low p.d. power supply also is not a hazard, unless water was spilled on it, in which case it would score for the 'spilled water' which in a typical science laboratory is a hazard by itself. Risks by themselves like electrocution, electric shock or burns did not score but were ignored if given with an appropriate hazard. About 75 % of the students scored this mark usually for identifying 'hot water' or the 'heater' as the hazard. While in this experiment it is unlikely that water is at boiling point, 'boiling water' was creditworthy for 'hot water'.

02.2

To score 5 or 6 marks, students needed to be clear how the mass of the water should be determined. There were some very good, straightforward methods seen to calculate specific heat capacity, a graphical approach scored no additional credit. Some students who had more complex methods often became confused with the significance of what the gradient of their graph represented. It was possible for a student to score 6 marks for measuring the energy needed to increase the temperature of a suitable volume of water by just 1°C as the method would work, even if the temperature change is not as large as may be needed to obtain an accurate value.

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4.3.1.1 Density of materials

02.3

Almost all of the students scored this mark for identifying that the beaker of water needed insulation and/or a lid. Any named insulation was allowed for this question. Aluminium / tin foil was also allowed as it would reduce energy transfer by infrared radiation. Place the beaker on a 'heatproof' mat was also creditworthy as it would decrease energy transfer through the base of the beaker by conduction.

02.4

Nearly three quarters of the students scored 2 marks for this percentage difference calculation. The most common mistake was to calculate the percentage difference between 4200 and 4410 which didn't score marks, unless they had set out the top of the equation correctly, (4410 – 4200) or (4200 – 4410) or calculated the difference of 210. Many students calculated 105 or 1.05, which scored no marks unless the working out was shown.

An answer of 4.76% or working showing a calculation of this figure, rounded to 5% scored no marks.

03.1

An answer of; 'Increase the resistance' without a method to do so was insufficient. 'Use the variable resistor' was just enough to score a mark, given there is a variable resistor in the circuit provided. Just over 60 % of the students scored the mark.

03.2

Almost all of the students chose the correct equation linking *I*, *V* and *R*.

03.3

Just fewer than 90 % of the students scored 4 marks, while a further 7 % of the students scored 3 marks. Reading the value of current from the graph proved difficult for a small minority of the students. A large tolerance was allowed for mark points 2, 3 and 4.

03.4

Most students identified that LEDs only allow charge to flow in one direction. Current in one direction was equivalent to this. Some students incorrectly thought that the ammeter was not capable of measuring a negative current, or thought that the order of the components mattered, or that the switch was open. Just over 20 % of the students scored 2 marks, while almost 30 % of the students scored 1 mark.

04.1

For marking point 1 a link was needed between the type of gas and the effect it has i.e. the greenhouse effect. Students who incorrectly linked carbon dioxide to ozone depletion could not score the first marking point. Most of the students scored at least 1 mark.

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4.3.1.1 Density of materials

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04.2

Just fewer than 80 % of the students read the correct value of 8000 kg from the graph. Students who answered incorrectly usually chose the wrong car and wrote 5000 kg or read the maximum value when the electric car had driven 100 000 km.

04.3

Just over 90 % of the students scored the mark for correctly reading where the two lines crossed over on the graph. A large tolerance was allowed as the two lines had similar gradients at the cross-over point.

04.4

A surprising number of the students thought that carbon dioxide exhaled by the passengers of the car was the cause of the additional carbon dioxide being released. Other incorrect ideas involved the breakdown of the battery or the tyres or the catalytic converter. Few students stated that the car/battery needed (re) charging. Even fewer students linked the electricity generated to a type of energy resource and usually just repeated the information given in the question. Only 15 % of the students scored 2 marks, while a further 35% of the students scored 1 mark.

04.5

Just over 70 % of the students chose nuclear and solar as the correct energy resources. The most common incorrect choice was biofuel.

05.1

Just over 80 % of the students scored 2 marks for correctly describing what is meant by an isotope of an element. The number of electrons was ignored as this does not define an isotope.

05.2

Students needed to say light / lighter / small nuclei to demonstrate they understood that it is only lighter nuclei which fuse. The word fuse could have been substituted for other words like ‘join’, or ‘combine’ but ‘collide’ was insufficient. Some students demonstrated an excellent understanding of the fusion process and fusion in stars was accurately described. Fusion on earth where an extra neutron is released was ignored, as the process as stated in the specification was being tested. Just fewer than 20 % of the students scored 3 marks, while nearly 30 % of the students scored 2 marks and approximately 15 % of the students scored 1 mark.

05.3

Most students who scored a mark did so for stating that the reactor walls should not melt. Few students scored the first marking point. Most students were vague and used phrases like the walls need to ‘withstand the high temperatures’ which did not score a mark. Many students confused specific heat capacity with thermal conductivity and thermal insulation. Containing the fusion energy or products was another common insufficient response. Only

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about 4 % of the students scored 2 marks, while approximately 40 % of the students scored 1 mark.

05.4

Just over 30 % of the students scored the mark for the consequence of an uncontrolled chain reaction. 'Explosion' unqualified was insufficient to score the mark.

06.1

Just over 90 % of the students scored 3 marks on this grade 4-5 calculation of temperature increase using the specific heat capacity equation.

06.2

Just over 80 % of the students scored 4 marks for this calculation of charge flow using the equation $E = QV$. About 15 % of the students scored 3 marks as they had either not converted or converted incorrectly the energy into Joules.

06.3

Students found this question difficult with very few scoring marks because of incorrect assumptions about how potential difference, current and resistance are affected by series and parallel circuits. Marking point 2 was dependent on marking point 1 so that students who stated that the current was increased without a valid reason would not score. The third mark was demanding in requiring an understanding of how $P = IV$ related to the circuit being considered. Just over 80% of the students scored no marks.

07.1

Nearly all of the students chose the correct reason for why scientists change the model used to describe the structure of an atom.

07.2

Many students were confused about the distinction between irradiation and radioactive contamination. Many thought that it had to do with being exposed to radiation inside or outside the body, or one causing harm the other not causing harm. Exposure to a radioactive source was insufficient to score the irradiation mark. Without using the word 'exposed' students often did not express their ideas clearly enough. 'Absorbing radiation from a source' would have been another way of gaining credit for this idea. Students were more secure explaining what radioactive contamination meant and often gave examples like 'radioactive dust' or radioactive atoms' being present on or in people / objects. Almost a quarter of the students scored 2 marks, while just over 40 % of the students scored 1 mark.

07.3

About 90 % of the students scored 2 marks for this nuclear equation, while about 5 % of the students scored 1 mark.

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07.4

'4 half-lives' needed to be seen to score the first mark, the number '4' was not sufficient by itself for a mark. The most common mistake was to divide 256 000 by 16 000 to give an answer of 16, which scored no marks. Just over 70 % of the students scored 3 marks.

07.5

More / less active was insufficient as was a description of activity in terms of rate of decay.
Just over 20 % of the students scored 2 marks, while a further 12 % of the students scored 1 mark.

08.1

Just fewer than 90 % of the students scored 4 marks on this calculation of specific latent heat. Students who did not convert or incorrectly converted the mass could score a maximum of 3 marks.

08.2

Most students did not refer to the energy of the particles in terms of kinetic and potential energy, so scoring no marks. Many students thought the kinetic energy of the particles changed which limited them to scoring only the first marking point. Only about 3 % of the students scored 2 or 3 marks, while just over 10 % of the students scored 1 mark.

08.3

Students made good attempts at answering this challenging question about gas pressure. Technical accuracy was important for the second and third marking points, so it needed to be clear that particle collisions with the container walls were more frequent, more often or at a greater rate of collision. More frequent collisions between particles was insufficient for the second mark. The third marking point needed to reference the forces involved in collisions with the container walls, an implied greater force per collision was acceptable, but not a macroscopic force linked to force and area as that was not being tested. Almost half of the students scored 3 or 4 marks, while almost 40 % of the students scored 1 or 2 marks.

09.1

Many of the students did not convert the 70 cm into metres and some students converted the energy unnecessarily. Not converting the height stopped marking point 1 from scoring and converting the energy unnecessarily stopped 1 marking point from being scored too. Some students, despite setting out their calculations correctly, did not use brackets around the denominator and arrived at an answer of 0.0245 or 2.45. Nearly 80 % of the students scored full marks on this question.

09.2

Many students found it easy to score full marks on this multi-step calculation. The most common mistake was not to convert the time which resulted in an answer of 27 and scored 5 marks. Converting the time incorrectly e.g. converting time into 0.5 hours also scored 5 marks. About 90% of the students scored either 5 or 6 marks.

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09.3

Many students understood that the flow rate would increase. This was often correctly linked to either more useful energy transferred or less wasted energy. Some students expressed their ideas in terms of power. Just over 40 % of the students scored 2 marks, while just over 40 % scored 1 mark.

10.1

Many students were successful with this multi-step calculation question. Nearly 60% of the students scored 6 marks, while almost 10 % scored 5 marks. A significant number of students tried to answer the question using equations from paper 2, which was creditworthy, but virtually no students arrived at the correct answer using this method. Some students scored the significant figures mark by completing an incorrect calculation using all the data provided in the question. The most common mistake was not squaring the extension in the elastic potential energy equation. Ensuring that students substitute first before rearranging is a good way of scoring method marks in calculations, even if the final answer is incorrect.

10.2

Students who stated the names of energy stores didn't score any marks unless they stated how the amount of energy changed or stated that kinetic energy was transferred to gravitational potential energy, for example. Mention of elastic potential energy from the spring in Q10.1 was ignored for this question. E_k and *KE* were acceptable abbreviations for kinetic energy; E_p and *GPE* were acceptable abbreviations for gravitational potential energy. Just over 60 % of the students scored 3 marks, while just over 10% scored 2 marks and just fewer than 10 % scored 1 mark.

10.3

Only about 25 % of the students scored 2 marks for identifying the correct measurements needed to determine the speed of the car at the end of the track. Nearly 75% of the students scored 1 mark. The most common incorrect choice was the length of the track.

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4.3.1.1 Density of materials

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Mark Ranges and Award of Grades

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

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