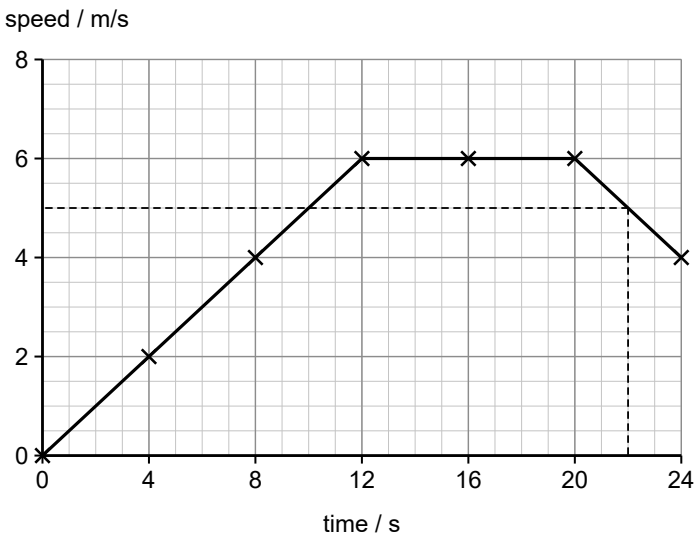
SCIENCE (PHYSICS) – Paper 2 Physics (set 2.5) – mark scheme

Use this to mark your own attempt. Accept any correct alternative that answers the question as set. Marks are for the ideas, not the exact words. Unless stated, ecf (error carried forward) applies in calculations. Chermistry practice paper – not an official examination paper.

Total marks: 65 (Section A: 55 marks; Section B: one question of 10 marks)

Textbook references are quoted word for word from *Discover Physics, 5th ed*.

Section A – Question 1 [6]

Part	Answer and mark points	Marks
1(a)	• **2×10^{-3} m** (2 mm) (1) • *Not accepted:* any other box (2×10^{-9} m is about the size of a few atoms, 2×10^{-6} m is smaller than a hair, 2 m is as big as a person)	1
1(b)	• the direction (in which the balloon is moving) (1) **Accept:** the direction of travel / the direction of the wind **Textbook: Discover Physics, 5th ed., p. 22 (Ch 2 Kinematics, 2.1)** > *"We have learnt in Chapter 1 that when determining the velocity of an object, we need to know the speed of the object and the direction in which it is travelling."*	1
1(c)	• speeds read from the table: 2.0 m/s at 4 s and 6.0 m/s at 12 s; acceleration = change in speed / time taken = (6.0 − 2.0) / (12 − 4) (1) • **0.50 m/s^2** (1) **Accept:** 0.5 m/s^2; allow ecf for a wrong substitution, 1 mark only if the unit is missing or wrong	2
1(d)	all seven points plotted correctly (to within half a small square) and joined with ruled straight lines (1)  The completed graph	1
1(e)	• **5.0 m/s** (read from the line between 20 s and 24 s) (1) **Accept:** 4.8 – 5.2 m/s; follow through from the candidate's own line	1

Section A – Question 2 [6]

Part	Answer and mark points	Marks
2(a)	• mass is the amount of matter in the panel (measured in kg, a scalar); weight is the gravitational force (pull of the Earth) acting on the panel (measured in N, a vector) (1) • mass does not depend on the gravitational field strength / is the same anywhere; weight depends on the gravitational field strength (1) **Accept:** any two correct differences, one mark each, e.g. unit (kg / N), scalar / vector, same everywhere / changes with gravitational field strength **Textbook: Discover Physics, 5th ed., p. 50 (Ch 3 Force and Pressure, 3.2)** > *"Weight is the gravitational force acting on an object that has mass."* **Textbook: Discover Physics, 5th ed., p. 53 (Ch 3 Force and Pressure, 3.2)** > *"As both the object and the standard masses experience the same gravitational field strength, the mass reading taken for a given object, whether on Earth or on the moon, will be the same."*	2
2(b)(i)	• weight = mg = 20 × 10 = 200 N; area = 1.6 × 1.0 = 1.6 m^2; $p = F / A$ = 200 / 1.6 = **125 N/m^2** (125 Pa) (1) **Accept:** 1.3 × 10^2 N/m^2; the single mark needs the weight, the area and the answer to be correct (ecf if the weight is wrong)	1
2(b)(ii)	• area = 1.0 × 0.050 = 0.050 m^2; $p = F / A$ = 200 / 0.050 = **4000 N/m^2** (4.0 × 10^3 Pa) (1) **Accept:** ecf from a wrong weight in (i); no mark if the area of the 1.6 m by 1.0 m face is used (125 N/m^2)	1
2(c)	• total mass of water = 12 + 3.0 = **15 kg** (1) • mass is a measure of the amount of matter; melting changes the state (shape) but not the amount of matter in the hailstones (1) **Accept:** the mass cannot be changed by the shape of the body; unit kg needed **Textbook: Discover Physics, 5th ed., p. 49 (Ch 3 Force and Pressure, 3.2)** > *"Mass is a measure of the amount of matter in a body."* **Textbook: Discover Physics, 5th ed., p. 49 (Ch 3 Force and Pressure, 3.2)** > *"It is a basic property of a body and cannot be changed by the location, shape and speed of the body (for speeds less than speed of light)."*	2

Section A – Question 3 [4]

Part	Answer and mark points	Marks
3(a)	• weight (downwards) and normal (reaction / contact) force (upwards) drawn from the dot as equal-length arrows, both labelled (1) • driving force from the wind (forwards) and resistive force (friction / air resistance, backwards) drawn from the dot as equal-length arrows, both labelled (1) **Accept:** allow 1 mark if all four forces are shown and labelled but lengths are not equal; no mark for a wind arrow drawn onto the sail instead of on the dot	2
3(b)	• the speed decreases (until the land yacht stops) (1) • there is no driving force but friction / air resistance still acts backwards, so the forces are unbalanced and the resultant force is backwards (so it decelerates) (1) • *Not accepted:* "it stops at once"; "it keeps moving because of its inertia" with no mention of the resistive force **Textbook: Discover Physics, 5th ed., p. 66 (Ch 4 Dynamics, 4.1)** > *"If the applied force F is now removed while the book is still in motion (Figure 4.6(b)), friction is the resultant force. The resultant force causes the book to decelerate and eventually stop."*	2

Section A – Question 4 [3]

Part	Answer and mark points	Marks
4(a)	• when a body is in equilibrium, the sum of the clockwise moments about a pivot equals the sum of the anticlockwise moments about the same pivot (1) **Accept:** the sum of the clockwise moments = the sum of the anticlockwise moments; the pivot must be the same point **Textbook: Discover Physics, 5th ed., p. 85 (Ch 5 Turning Effects of Forces, 5.2)** > *"The principle of moments states that when a body is in equilibrium, the sum of clockwise moments about a pivot is equal to the sum of anticlockwise moments about the same pivot."*	1
4(b)	• the weight of the model may be taken as acting at its centre of gravity X (1) • the model is in equilibrium, so the resultant moment about P is zero; the weight has no moment about P only when its line of action passes through P, so X is directly below P (1) **Accept:** the centre of gravity is directly below the pivot when the body is in balance **Textbook: Discover Physics, 5th ed., p. 88 (Ch 5 Turning Effects of Forces, 5.3)** > *"The centre of gravity of an object is an imaginary point where the entire weight of the object seems to act."* **Textbook: Discover Physics, 5th ed., p. 88 (Ch 5 Turning Effects of Forces, 5.3)** > *"If the body is in balance, then its centre of gravity is either directly below or above the pivot point."*	2

Section A – Question 5 [5]

Part	Answer and mark points	Marks
5(a)	• energy cannot be created or destroyed, it can only be transferred from one store to another (the total energy is constant) (1) • energy not supplied = 8.0 − 5.0 = **3.0 MJ** (transferred to the surroundings / wasted as thermal energy) (1) **Accept:** the total energy before = the total energy after; unit MJ is needed **Textbook: Discover Physics, 5th ed., p. 108 (Ch 6 Energy, 6.1)** > *"The principle of conservation of energy states that energy cannot be created or destroyed. Energy can be transferred from one store to another. The total energy of an isolated system is constant."*	2
5(b)	• $P = E / t = 1.8 \times 10^{10} / (1.0 \times 3600)$ (1) • **5.0×10^6 W** (5.0 MW) (1) **Accept:** 1 mark only if the time is not converted to seconds (5.0×10^9)	2
5(c)	• force = weight of the gate = 400 × 10 = 4000 N; $W = Fd = 4000 \times 2.5 =$ **1.0×10^4 J** (10 000 J) (1)	1

Section A – Question 6 [7]

Part	Answer and mark points	Marks
6(a)	• arrangement: particles in the steam are very far apart (irregular pattern); in the liquid water they are close together / touching (1) • the same particles (same mass) are now spread out over a much larger space: the steam particles move freely in any direction, with weak attractive forces between them, so they fill the space available (1) **Accept:** weak attractive forces between steam particles but significant attractive forces between liquid particles (may replace one of the points) **Textbook: Discover Physics, 5th ed., p. 125 (Ch 7 Kinetic Particle Model of Matter, 7.1 (gas))** > *"Particles are very far apart from one another in an irregular pattern."* **Textbook: Discover Physics, 5th ed., p. 125 (Ch 7 Kinetic Particle Model of Matter, 7.1 (gas))** > *"The particles can move freely in any direction. The attractive forces between the particles are weak."* **Textbook: Discover Physics, 5th ed., p. 125 (Ch 7 Kinetic Particle Model of Matter, 7.1 (liquid))** > *"The particles slide over each other throughout the liquid without fixed positions. The forces holding the particles together are weaker than in a solid."*	2
6(b)	• the internal energy is the total kinetic energy associated with the random motion of the particles and the total potential energy between the particles (both needed) (1) • the hotter water has particles with a higher average kinetic energy (they move faster), so its total kinetic energy, and so its internal energy, is greater (1) • *Not accepted:* "the heat energy in the water" with no mention of the particles **Textbook: Discover Physics, 5th ed., p. 124 (Ch 7 Kinetic Particle Model of Matter, 7.1)** > *"Internal energy is an energy store that is made up of the total kinetic energy associated with the random motion of the particles and the total potential energy between the particles in the system."* **Textbook: Discover Physics, 5th ed., p. 127 (Ch 7 Kinetic Particle Model of Matter, 7.2)** > *"Temperature rises with the average kinetic energy of the particles in a body and vice versa."*	2
6(c)	• from the water (hotter) to the soil (cooler) / from the region of higher temperature to the region of lower temperature (1) **Textbook: Discover Physics, 5th ed., p. 134 (Ch 8 Thermal Processes, 8.1)** > *"Energy is transferred from a region of higher temperature (hotter object) to a region of lower temperature (cooler object) until both regions have the same temperature."*	1
6(d)	• the particles (atoms / ions) at the hot surface vibrate more and pass the energy on to neighbouring particles through collisions (1) • the free electrons at the hot end gain energy, move quickly through the copper and transfer energy to the particles at the cooler end (1) **Accept:** the idea of vibrating particles passing on energy, and of free electrons carrying energy, must both be present **Textbook: Discover Physics, 5th ed., p. 137 (Ch 8 Thermal Processes, 8.2 (Conduction in Solids, metals))** > *"In addition to the same process in non-metals, the free electrons at this heated end gain energy from interacting with the particles. The small size and high speed of the electrons allow them to move easily and quickly to the cooler end and transfer energy to the particles there."*	2

Section A – Question 7 [6]

Part	Answer and mark points	Marks
7(a)	• the vibrating diaphragm (source) makes the air particles next to it vibrate (1) • sound needs a medium: the vibrations are passed from one air particle to its neighbour, so the sound travels through the air to the ship (1) • *Not accepted:* "the air carries the sound" with no mention of vibrations passed between particles **Textbook: Discover Physics, 5th ed., p. 172 (Ch 10 General Wave Properties II: Sound, 10.1)** *"Sound is a longitudinal wave created by a vibrating source."* **Textbook: Discover Physics, 5th ed., p. 173 (Ch 10 General Wave Properties II: Sound, 10.1)** *"Sound travels when the vibrations of atoms are passed on to neighbouring atoms."*	2
7(b)(i)	• compression: **Y**, rarefaction: **Z** (both needed) (1) **Textbook: Discover Physics, 5th ed., p. 172 (Ch 10 General Wave Properties II: Sound, 10.1)** *"The compressed regions are called compressions and the extended regions are called rarefactions (Figure 10.1)."*	1
7(b)(ii)	• a region where the air particles are further apart (more spread out / extended) than normal (1) **Accept:** the air pressure is lower than normal **Textbook: Discover Physics, 5th ed., p. 172 (Ch 10 General Wave Properties II: Sound, 10.1)** *"This causes alternate regions of the air particles to be compressed and extended. The compressed regions are called compressions and the extended regions are called rarefactions (Figure 10.1)."*	1
7(c)	• in a transverse wave the direction of vibration is perpendicular to the direction of wave travel; in a longitudinal wave it is parallel (1) • example: light (any electromagnetic wave) / a vibrating guitar string / a wave on a spring (any other correct example) (1) • *Not accepted:* waves on a rope (given in the question); sound waves (longitudinal) **Textbook: Discover Physics, 5th ed., p. 158 (Ch 9 General Wave Properties I, 9.2)** *"A transverse wave has a direction of vibration that is perpendicular to the direction of wave travel (Figure 9.9)."* **Textbook: Discover Physics, 5th ed., p. 158 (Ch 9 General Wave Properties I, 9.2)** *"A longitudinal wave has a direction of vibration that is parallel to the direction of wave travel (Figure 9.10)."* **Textbook: Discover Physics, 5th ed., p. 158 (Ch 9 General Wave Properties I, 9.2)** *"Some examples of transverse waves are light waves and a vibrating guitar string when plucked."*	2

Section A – Question 8 [4]

Part	Answer and mark points	Marks
8(a)(i)	• **transverse** (1) **Textbook: Discover Physics, 5th ed., p. 185 (Ch 11 Electromagnetic Waves, 11.1)** *"All electromagnetic waves are transverse waves."*	1
8(a)(ii)	• **500 s**, because all electromagnetic waves travel at the same speed in a vacuum (space) (both the time and the reason are needed) (1) **Accept:** the same time (about 8 minutes); same speed of 3.0×10^8 m/s **Textbook: Discover Physics, 5th ed., p. 185 (Ch 11 Electromagnetic Waves, 11.1)** *"All electromagnetic waves can travel without a medium and they all travel at the same speed of 3×10^8 m/s in a vacuum."*	1

8(b)(i)	• P: **negative** (it has gained electrons, so it has more electrons than protons); Q: **positive** (it has lost electrons, so it has fewer electrons than protons) (both needed) (1) • *Not accepted:* Q neutral; P positive **Textbook: Discover Physics, 5th ed., p. 226 (Ch 13 Electric Charge and Current of Electricity, 13.1)** > *"An electron is negatively charged while a proton is positively charged."* **Textbook: Discover Physics, 5th ed., p. 226 (Ch 13 Electric Charge and Current of Electricity, 13.1)** > *"The numbers of electrons and protons in an object determine if the object is charged (Table 13.1)."*	1
8(b)(ii)	• **coulomb** (C) (1) **Textbook: Discover Physics, 5th ed., p. 226 (Ch 13 Electric Charge and Current of Electricity, 13.1)** > *"The SI unit of electric charge is the coulomb (C)."*	1

Section A – Question 9 [7]

Part	Answer and mark points	Marks
9(a)	• $R = V / I = 230 / 2.5$ (1) • **92 Ω** (1)	2
9(b)	• the wire has a high resistance; the free electrons collide with the ions, which vibrate more, so electrical energy is transferred to the thermal (internal) energy store of the wire (1) **Accept:** electrical energy is transferred to thermal energy as the current passes through the (high resistance) wire **Textbook: Discover Physics, 5th ed., p. 268 (Ch 15 Practical Electricity, 15.1)** > *"All heating elements have high electrical resistances. These resistances oppose the flow of charge. In the case of alloys, the free electrons bump into ions, which are obstructions to the flow. As a result of the collision, the fixed-position ions vibrate more vigorously, which in turn raises the temperatures of the alloys."*	1
9(c)	• energy = power × time = 4 × 0.10 × (12 × 30) = 144 kW h (1) • cost = 144 × 28 = 4032 cents = **$40.32** (1) **Accept:** $40; $40.3; 1 mark for the energy in kW h if the cost is wrong or in cents only	2
9(d)	• $I = P / V = 400 / 230 = 1.7$ A (1) • **3 A**: the rating is just above the normal current, so the fuse does not melt in normal use but melts, and breaks the circuit, if the current rises above 3 A (1) • *Not accepted:* 13 A "because it is the safest"; 1 A (it would melt in normal use) **Accept:** 1.74 A; the second mark needs the 3 A fuse with the idea of a rating just above the normal current (ecf from a wrong current) **Textbook: Discover Physics, 5th ed., p. 276 (Ch 15 Practical Electricity, 15.2)** > *"A fuse is a safety device added to an electric circuit to prevent excessive current flow. It consists of a strip of fusible wire that will melt when the current flowing through it exceeds a certain value (Figure 15.12(a))."* **Textbook: Discover Physics, 5th ed., p. 276 (Ch 15 Practical Electricity, 15.2)** > *"Fuses come with different current ratings. Typical household fuses are rated at 1 A, 2 A, 3 A, 5 A, 10 A and 13 A."*	2

Section A – Question 10 [4]

Part	Answer and mark points	Marks
10(a)(i)	• **to the right** (1) • working: the field from N to S is downwards and the current is out of the page; Fleming's left-hand rule gives the force to the right **Textbook: Discover Physics, 5th ed., p. 310 (Ch 16 Magnetism and Electromagnetism, 16.4)** *"Next, the first finger is oriented in the direction of the magnetic field from north to south, and the second finger in the direction of conventional current. The resultant force that is induced by the current-carrying conductor will be given by the direction the thumb is pointing to."*	1
10(a)(ii)	• **to the right** (unchanged: both the current and the field are reversed, so the force is not reversed) (1) • *Not accepted:* to the left **Textbook: Discover Physics, 5th ed., p. 310 (Ch 16 Magnetism and Electromagnetism, 16.4)** *"Fleming's left-hand rule is used to find either the direction of the force, magnetic field or current when the directions of any two of these are known. The directions of the force, magnetic field or current are at right angles to one another."*	1
10(b)	• the student is not correct: the forces on the two sides of the coil are equal in size but in opposite directions (one up, one down) (1) • the two forces act at different places (on opposite sides of the axle) so they do not cancel as a turning effect: each produces a turning effect (a moment) in the same sense, so the coil turns (1) • *Not accepted:* "the coil is pushed in one direction"; a single force on the coil; "the student is correct" **Textbook: Discover Physics, 5th ed., p. 312 (Ch 16 Magnetism and Electromagnetism, 16.4)** *"The current-carrying coil experiences an equal force on parts AB and CD of the coil. This force is created by the motor effect on each side of the coil."* **Textbook: Discover Physics, 5th ed., p. 312 (Ch 16 Magnetism and Electromagnetism, 16.4)** *"The forces produce a turning effect that is equal in magnitude on each wire."*	2

Section A – Question 11 [3]

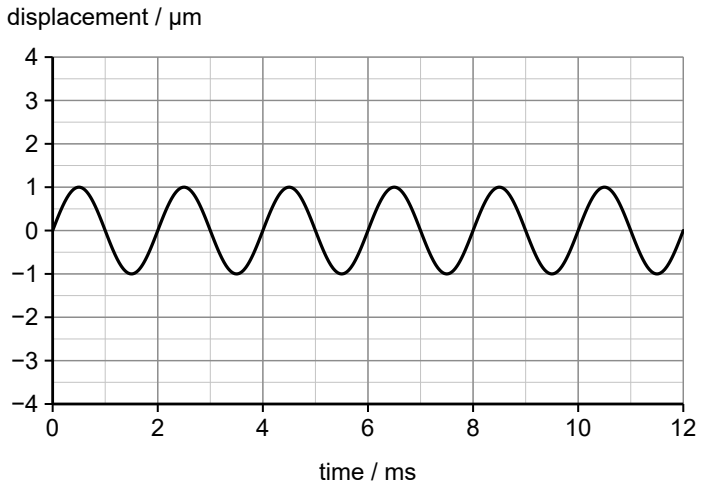
Part	Answer and mark points	Marks
11(a)	• **6** (a neutral atom has the same number of electrons as protons) (1) **Textbook: Discover Physics, 5th ed., p. 320 (Ch 17 Radioactivity, 17.1)** *"In a neutral atom, the total positive charge equals the total negative charge. Therefore, in a neutral atom, the number of protons is the same as the number of electrons."*	1
11(b)	• use (any one): e.g. gamma rays kill microbes to sterilise food or medical equipment; treating cancer / thyroid disorder; gamma-ray tracer to diagnose illness; smoke detector; monitoring the thickness of paper or metal (1) • hazard (any one): radiation damages / kills healthy cells; causes mutations; causes cancer (1) • *Not accepted:* dating wood or rocks (given in the question); "it is dangerous" with no effect on living things **Textbook: Discover Physics, 5th ed., p. 332 (Ch 17 Radioactivity, 17.3 (uses))** *"Food decays due to the action of microbes. γ-rays can be used to kill the microbes so that the food is safe for consumption and can last longer."* **Textbook: Discover Physics, 5th ed., p. 334 (Ch 17 Radioactivity, 17.3 (hazards))** *"While radioactive isotopes are used in the diagnosis and treatment of cancer, they can also damage healthy cells. The energy carried by the radiation can kill cells, and cause mutation and cancer."*	2

Section B – Question 12 [10]

Part	Answer and mark points	Marks
12(a)	• the 4.0 Ω and 8.0 Ω are in series: resistance of this branch = 4.0 + 8.0 = 12.0 Ω (1) • this branch is in parallel with the 6.0 Ω resistor: 1 / *R* = 1 / 12.0 + 1 / 6.0 (1) • effective resistance = **4.0 Ω** (1) **Accept:** *R* = (12.0 × 6.0) / (12.0 + 6.0) = 4.0 Ω for the second and third marks; ecf for a wrong series resistance **Textbook: Discover Physics, 5th ed., p. 251 (Ch 14 D.C. Circuits, 14.1)** > *"In a series circuit, the effective resistance Re is equal to the sum of the individual resistances."* **Textbook: Discover Physics, 5th ed., p. 256 (Ch 14 D.C. Circuits, 14.2)** > *"The reciprocal of the effective resistance is the sum of the reciprocal of the individual resistances."*	3
12(b)	• current = 12 / 12.0 = 1.0 A; p.d. across 4.0 Ω = 1.0 × 4.0 = 4.0 V (1) (ecf from the series resistance in (a)) • in a series circuit the p.d. across the whole branch equals the sum of the p.d.s across the parts, so p.d. across 8.0 Ω = 12 − 4.0 = **8.0 V** (1) **Accept:** the same answer by a ratio of resistances (4.0 : 8.0) with a reason scores both marks **Textbook: Discover Physics, 5th ed., p. 251 (Ch 14 D.C. Circuits, 14.1)** > *"In a series circuit, the total potential difference supplied to the circuit Vε is equal to the sum of the individual potential differences across the resistors."*	2
12(c)	• the distance between the (optical) centre of the lens and the principal focus F (1) • F is the point where rays parallel to the principal axis meet after passing through the lens, so the energy of the sunlight is concentrated on a small spot there (elsewhere it is spread over a larger area) (1) **Accept:** the focal length is the distance from the lens to the point where parallel rays are focused; a distance measured from the card to the Sun or to the edge of the lens scores 0 **Textbook: Discover Physics, 5th ed., p. 216 (Ch 12 Light, 12.3 (Focal length f))** > *"The distance between the optical centre C and the principal focus point F"* **Textbook: Discover Physics, 5th ed., p. 216 (Ch 12 Light, 12.3 (Principal focal point F))** > *"The point on the principal axis where all rays parallel to the principal axis meet after passing through the lens"*	2
12(d)	• cloud: **real, inverted, diminished**; thermometer scale: **virtual, upright, magnified** (each row is worth 1 mark: both words correct) • reason: the cloud is more than 2*f* from the lens; the scale is 3.0 cm from the lens, which is less than *f* = 4.0 cm • *Not accepted:* both words of a pair given in the same box (no mark for that row) **Textbook: Discover Physics, 5th ed., p. 219 (Ch 12 Light, 12.3 (Table 12.2))** > *"The distance of an object from a thin converging lens determines the type of image formed."* **Textbook: Discover Physics, 5th ed., p. 217 (Ch 12 Light, 12.3)** > *"In this arrangement, the lens will function as a magnifying glass. Hence the viewer will see an enlarged image of the object."*	3

Section B – Question 13 [10]

Part	Answer and mark points	Marks
13(a)(i)	• $^{131}_{53}\mathrm{I}$ (the 131 above the 53, before the symbol) (1) • *Not accepted:* the numbers the wrong way round, or the symbol missing **Textbook: Discover Physics, 5th ed., p. 321 (Ch 17 Radioactivity, 17.1)** > *"In nuclear physics and nuclear chemistry, the various species of atoms whose nuclei contain a particular number of protons and neutrons are called nuclides."*	1
13(a)(ii)	• number of neutrons = $A - Z$ = 131 − 53 = **78** (1) **Textbook: Discover Physics, 5th ed., p. 321 (Ch 17 Radioactivity, 17.1)** > *"Number of neutrons = nucleon number A – proton number Z in a nucleus"*	1
13(b)	• half-life = 8 days (the count rate halves from 800 to 400 counts per minute between 0 and 8 days) (1) • 800 → 400 → 200 → 100 → 50 is 4 half-lives (1) • time = 4 × 8 = **32 days** (1) **Accept:** ecf for a wrong half-life (e.g. 4 × 4 = 16 days if 4 days is used); unit needed **Textbook: Discover Physics, 5th ed., p. 328 (Ch 17 Radioactivity, 17.2)** > *"The half-life of a radioactive nuclide is the time taken for half the nuclei of that nuclide in any sample to decay."*	3
13(c)	• amplitude = **2.0 μm** (1) • period = 4.0 ms = 0.0040 s; frequency = 1 / period = 1 / 0.0040 = **250 Hz** (1) **Accept:** frequency = number of oscillations per second: 3 cycles in 12 ms gives 250 Hz; unit needed for each mark **Textbook: Discover Physics, 5th ed., p. 161 (Ch 9 General Wave Properties I, 9.2)** > *"The frequency f is the number of oscillations each point on the wave completes per second."*	2
13(d)(i)	• Q is quieter because its amplitude is smaller (loudness depends on amplitude) (1) • Q has the higher pitch because its frequency is higher (pitch depends on frequency) (1) **Accept:** each statement must be given with its reason **Textbook: Discover Physics, 5th ed., p. 175 (Ch 10 General Wave Properties II: Sound, 10.2)** > *"Loudness is generally related to the amplitude of a sound wave. The larger the amplitude, the louder the sound."* **Textbook: Discover Physics, 5th ed., p. 175 (Ch 10 General Wave Properties II: Sound, 10.2)** > *"The higher the frequency, the higher the pitch."*	2

13(d)(ii)	a smooth sine curve of amplitude 1.0 μm and period 2.0 ms (six complete cycles in 12 ms) (1)  The completed graph for Q **Accept:** amplitude 1.0 μm (± 0.25) and 5 to 7 cycles in 12 ms	1