cookie

Practice paper: mark scheme

GCSE Physics Higher, practice paper 2 (AQA style)

In the style of AQA GCSE Physics (8463) Paper 2 Higher

Practice paper written by cookie in the style of AQA GCSE Physics (8463) Paper 2 Higher. Not an AQA paper; not affiliated with or endorsed by AQA.

This mark scheme was written by cookie with its practice paper. Each row gives the answer, the marks and how they are given; where an answer is worded differently but means the same, give the mark.

Key

- Each line is one marking point, worth one mark unless it says otherwise.
- allow an answer that is also acceptable; do not accept an answer that gets no mark; ignore words that neither gain nor lose the mark
- Extended responses (6 marks) are marked by level: decide the level from the descriptors, then the mark within it.

Do it online, timed and marked:
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Question	Answer and marking	Marks
01.1	**Answer: D** D (1)	**1**
01.2	**Answer: 28 N forwards** (46 − 18 =) 28 N (1) forwards / in the direction of the pull (1) *Allow 'to the front' or 'in the direction the child pulls'. Do not accept 64 N.*	**2**
01.3	**Answer: 1150 J** W = 46 × 25 (1) W = 1150 (J) (1) *An answer of 1150 J with no working scores 2 marks. Allow 1200 J. Using the resultant force (28 × 25 = 700 J) scores 0.*	**2**
01.4	**Answer: 1.2 m** moment of child A = 320 × 1.5 = 480 (N m) (1) 400 × d = 480 (1) d = 1.2 (m) (1) *An answer of 1.2 m with no working scores 3 marks. Allow ecf from an incorrect moment for the last two marks. An answer of 1.875 m (400 × 1.5 ÷ 320) scores 0.*	**3**
02.1	**Answer: 40 N/m** extension = 22.0 − 12.0 = 10.0 cm = 0.100 m (or another correct pair from 1.0 N to 5.0 N) (1) 4.0 = k × 0.100 (1) k = 40 (N/m) (1) *Any load from 1.0 N to 5.0 N gives 40 N/m. Using the length instead of the extension (4.0 ÷ 0.22 = 18 N/m) scores 0. An answer of 0.4 (extension left in cm) scores 2 marks. Using the 6.0 N result (38 N/m) scores 2 marks.*	**3**
02.2	**Answer: 6.0 N: the extension was 15.6 cm, more than the 15.0 cm a proportional spring would give.** 6.0 N (1) the extension at 6.0 N is 15.6 cm, but if extension were proportional to force it would be 15.0 cm / the length increased by 3.1 cm, not 2.5 cm, for the last 1.0 N (1) *Allow 'between 5.0 N and 6.0 N' for the first mark. The second mark needs data from the table.*	**2**
02.3	**Answer: 0.20 J** Ee = 0.5 × 40 × 0.100^2 (1) Ee = 0.20 (J) (1) *Allow ecf from 02.1 for both marks. An answer of 2000 (extension in cm) scores 1 mark. Allow work done = elastic potential energy stored.*	**2**
02.4	**Answer: To avoid parallax error, so the reading is more accurate.** to avoid / reduce parallax error (1) *Allow 'so the reading is accurate'. Do not accept 'to make it a fair test' or 'to make it reliable'.*	**1**

02.5 **Answer: B** **1**

B (1)

03.1 **Answer: Extended response: see mark scheme.** **6**

Level 3 (5–6 marks): A coherent, detailed method that would give valid results. The apparatus is set up clearly, the force is changed while the total mass is kept constant, the acceleration is found from the measurements, and the results are processed to show the relationship.
Level 2 (3–4 marks): A method that would give some valid results, with the force changed and the acceleration measured, but with some steps missing or unclear (for example, how the mass is kept constant or how the acceleration is found).
Level 1 (1–2 marks): Some relevant statements about the apparatus or measurements, but not a workable method.
0 marks: No relevant content.
Indicative content:
• attach the pulley to the end of the bench; tie the string to the trolley and pass it over the pulley to the hanger
• the weight of the hanger and masses provides the accelerating force (weight = mass × 9.8 N/kg)
• fix a card of known length to the trolley and set up two light gates a measured distance apart along the bench
• release the trolley from rest at the same point each time
• the data logger gives the speed at each gate and the time between the gates; acceleration = change in velocity ÷ time
• (alternatively use one light gate with a double interrupt card, or a measured distance and a stopwatch with $s = \frac{1}{2} a t^2$)
• increase the force by moving a slotted mass from the trolley to the hanger, so the total mass of the system stays constant
• take readings for at least five different forces
• repeat each force and calculate a mean acceleration
• tilt the bench slightly so the trolley just moves at constant speed when pushed, to compensate for friction
• plot a graph of acceleration against force: a straight line through the origin shows acceleration is directly proportional to resultant force
• safety: place a box of padding under the hanger in case masses fall
A method that changes the mass of the trolley instead of the force scores a maximum of Level 1. A method that adds masses to the hanger without removing them from the trolley can reach Level 2 but not Level 3 (the total mass changes).

03.2 **Answer: B** **1**

B (1)

03.3 **Answer: At first weight is greater than air resistance, so she accelerates; air resistance increases with speed until it equals her weight; the resultant force is then zero, so the velocity is constant.** **3**

at first, the weight is greater than the air resistance, so the skydiver accelerates (1)
as the speed increases, the air resistance / drag increases (1)
until the air resistance equals the weight, so the resultant force is zero and the skydiver falls at a constant velocity / acceleration is zero (1)
Allow 'drag' or 'frictional forces' for air resistance. Do not accept 'gravity decreases'. Do not accept 'the forces cancel' for the third mark without the idea that the air resistance has become equal to the weight.

04.1 **Answer: 1.5 m/s^2** **2**

a = 9.0 ÷ 6 (1)

a = 1.5 (m/s^2) (1)

An answer of 1.5 m/s^2 with no working scores 2 marks.

04.2 **Answer: 27 m** **2**

½ × 6 × 9.0 (area under the velocity–time graph) or mean velocity 4.5 m/s × 6 (1)

distance = 27 (m) (1)

Allow a correct use of $v^2 - u^2 = 2\,a\,s$ with their acceleration ($81 = 2 \times 1.5 \times s$). An answer of 54 m (9.0 × 6) scores 0.

04.3 **Answer: 16.8 m** **2**

s = 24 × 0.70 (1)

s = 16.8 (m) (1)

Allow 17 m.

04.4 **Answer: 64.8 m** **3**

$0^2 - 24^2 = 2 \times (-6.0) \times s$ (1)

braking distance s = 48 (m) (1)

stopping distance = 16.8 + 48 = 64.8 (m) (1)

Allow ecf from 04.3 for the last mark. Allow 65 m. Sign errors that give a braking distance of 48 m are not penalised. An answer of 48 m on its own scores 2 marks.

04.5 **Answer: Tiredness (or drugs, alcohol, distractions).** **1**

any one from: tiredness; (taking) drugs; (drinking) alcohol; distractions, e.g. using a mobile phone (1)

Do not accept factors that affect braking distance, e.g. wet road, worn tyres or worn brakes. Do not accept 'age' on its own.

05.1 **Answer: p = m v** **1**

p = m v (1)

Allow momentum = mass × velocity or any correct rearrangement.

05.2 **Answer: 2.0 m/s** **3**

momentum before = 2400 × 3.5 = 8400 (kg m/s) (1)

8400 = (2400 + 1800) × v (1)

v = 2.0 (m/s) (1)

An answer of 2.0 m/s with no working scores 3 marks. An answer of 4.67 m/s (8400 ÷ 1800) scores 1 mark.

05.3 **Answer: 645 N** **3**

change in momentum = 0.43 × 18 = 7.74 (kg m/s) (1)

F = 7.74 ÷ 0.012 (1)

F = 645 (N) (1)

Allow 650 N or 640 N. Allow the first two marks for F = 0.43 × 18 ÷ 0.012 in one step. An answer of 7.74 N scores 1 mark.

05.4 — **3**

Answer: The foam increases the time taken for the head to stop, so the rate of change of momentum is smaller, so the force on the head is smaller.
the foam crushes, so the time taken for the head to stop increases (1)
so the rate of change of momentum decreases (1)
so the force on the head is smaller (1)
Allow 'the deceleration is smaller' for the second mark. Do not accept 'the foam absorbs the force' or 'the foam absorbs the impact'. The change in momentum is the same: do not accept 'the momentum is reduced' for the second mark.

06.1 — **2**

Answer: 121 000 Pa
p = 12 × 1030 × 9.8 (1)
p = 121 000 (Pa) (1)
Allow 121 128 Pa or 1.21 × 10^5 Pa. Adding atmospheric pressure is not required but is not penalised if the pressure due to the water is shown.

06.2 — **2**

Answer: There is a greater height of water above, so a greater weight of water acts on each unit of area.
there is a greater height / column of water above (1)
so there is a greater weight of water (pushing down) on each unit of area (1)
Do not accept 'there is more water' on its own for the second mark.

06.3 — **2**

Answer: The bottom surface is deeper than the top, so the pressure on it is greater; the upward force on the bottom is larger than the downward force on the top.
the bottom of the object is deeper than the top, so the pressure on the bottom surface is greater (1)
so the upward force on the bottom is greater than the downward force on the top, giving a resultant force upwards (1)
Allow 'water pressure acts in all directions / at right angles to every surface' as part of a correct answer. Do not accept 'the object is lighter than water' for any marks.

06.4 — **1**

Answer: 12 N upwards
12 N upwards (1)
Both the size and the direction are needed for the mark. Ignore any reference to the block floating to the surface.

07.1 — **1**

Answer: B
B (1)

07.2 — **1**

Answer: 1.5 Hz
(12 ÷ 8.0 =) 1.5 (Hz) (1)
Do not accept 0.67 Hz (that is the period).

07.3 — **3**

Answer: 0.027 m/s
wavelength = 18 ÷ 10 = 1.8 cm = 0.018 m (1)
v = 1.5 × 0.018 (1)
v = 0.027 (m/s) (1)
Allow ecf from 07.2. Dividing by 11 (wavelength 1.64 cm, v = 0.025 m/s) scores 2 marks. An answer of 2.7 (cm/s, unit not converted) scores 2 marks, including 2.7 cm/s: the question asks for m/s.

07.4 **Answer: One wavelength is small, so measuring across ten reduces the uncertainty (is more accurate).** **1**

one wavelength is small / difficult to measure accurately, so measuring several and dividing gives a more accurate value / reduces the (percentage) uncertainty (1)

Do not accept 'to make it a fair test' or 'to make it more reliable' on its own.

07.5 **Answer: One edge of each wave front enters the glass first and slows down while the rest is still in air moving faster, so the wave front turns and the light bends towards the normal.** **3**

light travels more slowly in glass than in air (1)

one side / end of the wave front enters the glass first and slows down, while the other side is still moving faster in the air (1)

so the wave front changes direction / the light bends towards the normal (1)

Do not accept 'the light speeds up in the glass'. The idea of different parts of the wave front travelling at different speeds is needed for the second mark.

07.6 **Answer: 0.10 m** **3**

distance travelled = $1540 \times 0.13 \times 10^{-3} = 0.2002$ (m) (1)

depth = $0.2002 \div 2$ (1)

depth = 0.10 (m) (1)

Allow 0.1001 m or 10 cm. An answer of 0.20 m (not halved) scores 1 mark. An answer of 100 (ms not converted, then halved) scores 1 mark.

08.1 **Answer: Microwaves: satellite communications or cooking food. Infrared: electrical heaters, cooking food or infrared cameras.** **2**

microwaves: satellite communications / cooking food / mobile phone signals (1)

infrared: electrical heaters / cooking food / infrared cameras / remote controls (1)

Cooking / heating food is a correct use of both microwaves and infrared, so it can score both marks.

08.2 **Answer: 3.05 m** **2**

$3.0 \times 10^{8} = 98.4 \times 10^{6} \times \lambda$ (1)

$\lambda = 3.05$ (m) (1)

Allow 3.0 m or 3.048 m. An answer of 3.05×10^{6} (MHz not converted) scores 1 mark.

08.3 **Answer: Matt black; for example the distance between the detector and the face.** **2**

matt black (1)

any one from: the distance from the detector to each face; the temperature of the water / take all readings at the same time after filling; the same detector (1)

Do not accept 'the amount of water' (all four faces share the same water) for the second mark.

08.4 **Answer: The planet absorbs radiation at the same rate as it emits radiation.** **2**

the planet absorbs radiation (from its star) and emits radiation (into space) (1)

at the same rate / the power absorbed equals the power emitted (1)

Do not accept 'it absorbs the same amount as it emits' without the idea of rate or of the same time, for the second mark.

08.5 **Answer: 3.0** **2**

magnification = 4.2 ÷ 1.4 (1)
magnification = 3.0 (1)
Allow 3 or ×3. Magnification has no unit: ignore cm only if the number is correct. An answer of 0.33 scores 0.

09.1 **Answer: Increase the current; increase the number of turns (or use an iron core).** **2**

any two from: increase the current / use more cells; increase the number of turns (of wire) on the coil; put an iron core inside the coil / replace the wooden rod with an iron rod (2)
Do not accept 'a bigger battery' unless linked to a larger current or potential difference. Allow 'a soft iron core' or 'an iron nail' for an iron core. Do not accept 'thicker wire' or 'a longer rod' on its own.

09.2 **Answer: 0.012 N** **2**

F = 0.040 × 2.5 × 0.12 (1)
F = 0.012 (N) (1)
An answer of 1.2 (length not converted) scores 1 mark. Allow 1.2 × 10^{-2} N.

09.3 **Answer: C** **1**

C (1)

09.4 **Answer: As the coil rotates it cuts the magnetic field lines, inducing a potential difference; each half turn the sides of the coil move the opposite way through the field, so the potential difference reverses.** **3**

the coil cuts the magnetic field lines / the magnetic field through the coil changes as it rotates (1)
so a potential difference is induced across the coil (1)
every half turn each side of the coil moves in the opposite direction through the field, so the direction of the potential difference reverses (1)
Allow 'current is induced' for the second mark only if the coil is said to be part of a complete circuit. Do not accept 'the magnet produces electricity'.

09.5 **Answer: 240** **2**

230 ÷ 12 = 4600 ÷ ns (1)
ns = 240 (1)
An answer of 88 167 (ratio inverted: 4600 × 230 ÷ 12) scores 0.

09.6 **Answer: 0.12 A** **2**

230 × Ip = 12 × 2.3 (1)
Ip = 0.12 (A) (1)
An answer of 44 A (230 × 2.3 ÷ 12) scores 0.

10.1 **Answer: Extended response: see mark scheme.** **6**

Level 3 (5–6 marks): A clear, detailed and correctly ordered description of the whole life cycle, from the nebula to a neutron star or black hole, including fusion and the balance of forces in the main sequence stage, and the supernova.
Level 2 (3–4 marks): A description of most of the stages in the correct order, with some explanation, for example of fusion or of the supernova, but with some stages or explanations missing.
Level 1 (1–2 marks): Some correct stages named or simple relevant statements, but not in a clear order or with no explanation.
0 marks: No relevant content.
Indicative content:
• the star forms from a cloud of dust and gas (a nebula)
• the force of gravity pulls the dust and gas together to form a protostar
• the temperature rises as the protostar becomes denser
• when it is hot enough, nuclear fusion of hydrogen nuclei into helium begins
• the star is then a main sequence star: stable for a long time
• because the inward force of gravity is balanced by the outward pressure / force due to the energy released by fusion
• when the hydrogen begins to run out, the star expands and becomes a red supergiant
• in a red supergiant, heavier elements (up to iron) are formed by fusion
• the star then explodes in a supernova
• elements heavier than iron are formed in the supernova, and the explosion spreads the elements through the universe
• the core left behind becomes a neutron star, or a black hole if the star is massive enough
A description of the Sun's life cycle (red giant, white dwarf, black dwarf) scores a maximum of Level 1 unless the stages up to the main sequence are also described correctly, when it can reach Level 2.

10.2 **Answer: Its direction is always changing, and velocity includes direction; gravity acts towards the centre of the Earth.** **2**

the direction of motion of the satellite is (continuously) changing, and velocity is a vector / has a direction (1)
because the force of gravity on the satellite acts towards the centre of the Earth / at right angles to its motion (1)
Allow 'it is accelerating towards the centre' for the second mark.

10.3 **Answer: The radius is smaller.** **1**

it is smaller (1)
Allow 'closer to the Earth'.

10.4 **Answer: Galaxies further away have a greater red-shift, so they are moving away faster; the universe is expanding, so it began from a very small, extremely hot and dense region.** **3**

the wavelength of light from distant galaxies is increased / red-shifted, so the galaxies are moving away from us (1)
the further away a galaxy is, the greater its red-shift / the faster it is moving away (1)
so the universe is expanding, which suggests it began from a very small region that was extremely hot and dense (1)
Do not accept 'the galaxies are turning red'. Allow 'space itself is expanding' for the

third mark only with the idea of a small starting point.

Total: 100 marks