cookie

Practice paper: mark scheme

GCSE Physics Higher, practice paper 1 (AQA style)

In the style of AQA GCSE Physics (8463) Paper 1 Higher

Practice paper written by cookie in the style of AQA GCSE Physics (8463) Paper 1 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:
cookie.education/past-papers/gcse/cookie/physics-aqa-style

Question	Answer and marking	Marks
01.1	**Answer: B** B (1)	**1**
01.2	**Answer: Ep = m g h** Ep = m g h (1) *Allow gravitational potential energy = mass × gravitational field strength × height. Allow any correct rearrangement.*	**1**
01.3	**Answer: 10 900 J** Ep = 62 × 9.8 × 18.0 (1) Ep = 10 900 (J) (1) *Allow 10 936.8 J for 1 mark (not rounded to 3 significant figures). An answer of 10 900 J with no working scores 2 marks. Allow 1.09 × 10^4 J.*	**2**
01.4	**Answer: 6.9 m/s** Ep = 0.058 × 9.8 × 2.4 = 1.364 (J) (1) 1.364 = 0.5 × 0.058 × v^2 (1) v = 6.9 (m/s) (1) *Allow v^2 = 2 × 9.8 × 2.4 = 47.04 for the first two marks. Allow 6.86 m/s. An answer of 47 (v^2 not square-rooted) scores 2 marks.*	**3**
01.5	**Answer: 0.095 m** 0.72 = 0.5 × 160 × e^2 (1) e^2 = 0.0090 (1) e = 0.095 (m) (1) *Allow 0.0949 m. Allow 9.5 cm only if the unit is changed correctly. An answer of 0.0090 m (not square-rooted) scores 2 marks. Compression is treated in the same way as extension.*	**3**
02.1	**Answer: efficiency = useful output energy transfer ÷ total input energy transfer** efficiency = useful output energy transfer ÷ total input energy transfer (1) *Allow the equation in symbols or any correct rearrangement. Allow efficiency = useful power output ÷ total power input.*	**1**
02.2	**Answer: 0.61 (61%)** useful output energy = 15 × 9.8 × 4.0 = 588 (J) (1) total input energy = 120 × 8.0 = 960 (J) (1) efficiency = 588 ÷ 960 (1) efficiency = 0.61 / 61% (1) *Allow 0.6125 or 61.25%. Allow a power method: useful power = 588 ÷ 8.0 = 73.5 W, efficiency = 73.5 ÷ 120. Allow ecf for the last two marks. Do not accept an efficiency greater than 1 (or 100%) for the last mark.*	**4**
02.3	**Answer: Lubricate the moving parts to reduce friction, so less energy is dissipated as thermal energy.** lubricate the moving parts / bearings (1) to reduce friction so less energy is wasted / dissipated (as thermal energy to the surroundings) (1) *Allow 'use wires with lower resistance' (1) 'so less energy is dissipated by heating*	**2**

the wires' (1). The reason must match the change.

02.4 **Answer: Wind: renewable, no CO2 while generating, no fuel cost, but unreliable and lower average output. Gas: reliable and quick to start, higher average output, but non-renewable, releases CO2 and has variable fuel costs. A justified conclusion.** **4**

any three from:
• the wind farm is renewable / will not run out; gas is non-renewable (1)
• the wind farm releases no carbon dioxide when generating, so it does not add to global warming / climate change; the gas power station does (1)
• the wind farm's average output is lower: 360 MW compared with 495 MW (1)
• the wind farm is unreliable / depends on the wind, so it cannot always meet demand (1)
• the gas power station can be started quickly to meet sudden increases in demand (1)
• the wind farm has no fuel cost; the gas station's fuel cost changes with the gas price (1)
a justified conclusion, for example using both: wind most of the time with gas to cover high demand or low wind (1)
Maximum 3 marks if no conclusion is given. The average outputs (0.40 × 900 = 360 MW and 0.55 × 900 = 495 MW) need not be calculated for credit, but a comparison of average output must be correct. Ignore cost of building unless linked to the data.

03.1 **Answer: 48 W** **2**

P = 12.0 × 4.0 (1)
P = 48 (W) (1)
An answer of 48 W with no working scores 2 marks.

03.2 **Answer: 28 800 J** **2**

E = 48 × 600 (1)
E = 28 800 (J) (1)
Allow ecf from 03.1. Using t = 10 (minutes), giving 480, scores 1 mark. Allow 2.88 × 10^4 J.

03.3 **Answer: 960 J/kg °C** **3**

temperature change = 49.5 − 19.5 = 30.0 (°C) (1)
28 800 = 1.00 × c × 30.0 (1)
c = 960 J/kg °C (1)
Allow ecf from 03.2. The unit is required for the third mark: allow J/kg °C, J/kg K or J kg^{-1} $°C^{-1}$.

03.4 **Answer: Some energy from the heater was transferred to the surroundings, so the energy used in the calculation was more than the energy gained by the block.** **2**

some energy from the heater was transferred to the surroundings / not all of the energy heated the block (1)
so the energy used in the calculation was greater than the energy gained by the block (so the temperature rise was smaller than expected) (1)
Do not accept 'human error' or 'heat loss' alone for the first mark without a reference to the surroundings.

03.5 **Answer: 115 s** **3**

ΔE = 0.80 × 4200 × 75 = 252 000 (J) (1)
t = 252 000 ÷ 2200 (1)
t = 115 (s) (1)
Allow 114.5 s or 114.55 s. Allow ecf from an incorrect energy for the last two marks. Using 2.2 instead of 2200 (answer 114 545 s) scores 2 marks.

04.1 **Answer: B** **1**

B (1)

04.2 **Answer: 8.0 V** **3**

total resistance = 4.0 + 8.0 = 12 (Ω) (1)
current = 12 ÷ 12 = 1.0 (A) (1)
V = 1.0 × 8.0 = 8.0 (V) (1)
Allow a ratio method: R2 has 8/12 of the total resistance, so 8/12 × 12 = 8.0 V, for 3 marks. An answer of 8 V with no working scores 3 marks.

04.3 **Answer: 150 C** **2**

Q = 1.0 × 150 (1)
Q = 150 (C) (1)
Allow ecf from the current in 04.2. Using t = 2.5 (answer 2.5 C) scores 1 mark.

04.4 **Answer: 1800 J** **2**

E = 150 × 12 (1)
E = 1800 (J) (1)
Allow ecf from 04.3. Allow a power method: P = 12 × 1.0 = 12 W, E = 12 × 150 = 1800 J.

04.5 **Answer: The total resistance of the circuit decreases, so the current (ammeter reading) increases.** **2**

the total resistance (of the circuit) decreases (because the resistance of two resistors in parallel is less than either resistor alone) (1)
so the current / ammeter reading increases (1)
The second mark depends on a reason being given. 'The reading increases' with no reason scores 0.

05.1 **Answer: V = I R** **1**

V = I R (1)
Allow potential difference = current × resistance or any correct rearrangement.

05.2 **Answer: 11 Ω** **3**

6.0 = 0.55 × R (1)
R = 10.9 (Ω) (1)
R = 11 (Ω) to 2 significant figures (1)
An answer of 11 Ω with no working scores 3 marks. An answer of 0.092 (I ÷ V) scores 0.

05.3 **Answer: As the current increases, the filament gets hotter, the ions in the metal vibrate more, and the electrons collide with them more often.** **3**

as the potential difference increases the current increases, so the temperature of the filament increases (1)

the ions / atoms in the filament vibrate more (1)

so the electrons (flowing through the filament) collide with the ions more often / it is harder for electrons to pass through (1)

Do not accept 'the electrons vibrate more'. Do not accept 'the resistance increases because the voltage increases' without reference to temperature.

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

Level 3 (5–6 marks): A coherent, detailed method that would give valid results. The circuit is described clearly, the measurements and the way resistance is found from them are given, the length is changed in a controlled way, and the results are used to find the relationship.

Level 2 (3–4 marks): A method that would give some valid results, with the circuit and the measurements described, but with some steps missing or unclear (for example, how resistance is calculated, or how the length is measured).

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:

• connect the wire in series with a power supply (battery), an ammeter and a switch

• connect a voltmeter in parallel across the length of wire being tested

• fix the wire along a metre ruler, attach one crocodile clip at 0 cm

• attach the second crocodile clip at a measured length, e.g. 10 cm

• switch on and record the current and the potential difference

• calculate the resistance using resistance = potential difference ÷ current

• repeat for a range of lengths, e.g. 10 cm to 100 cm in 10 cm steps

• repeat each length and calculate a mean resistance

• use the same wire (same material and thickness) throughout

• use a low potential difference / switch off between readings so the wire does not heat up, because temperature affects resistance

• plot a graph of resistance against length; resistance should be directly proportional to length

• safety: the wire can get hot, so do not touch it while the current flows

A method that changes the thickness or material of the wire instead of its length scores a maximum of Level 1. Using an ohmmeter instead of an ammeter and voltmeter can reach Level 3 if the rest of the method is complete.

06.1 **Answer: 50 Hz and 230 V** **2**

frequency: 50 Hz (1)

potential difference: 230 V (1)

The units are needed for each mark.

06.2 **Answer: C** **1**

C (1)

06.3 **Answer: 400 000 W** **2**

$P = 400^2 \times 2.5$ (1)

P = 400 000 (W) (1)

Allow 4.0×10^5 W or 400 kW. Using P = I × R (answer 1000 W) scores 0.

06.4 **Answer: Step-up transformers increase the potential difference, which reduces the current for the same power, so less energy is lost by heating the cables.** **3**

step-up transformers increase the potential difference (1)
for the same power, this reduces the current (in the cables) (1)
so less energy is transferred by heating the cables / the system is more efficient (1)
Allow 'less energy is wasted'. Ignore references to step-down transformers.

06.5 **Answer: Friction transfers electrons from the cloth to the rod; the cloth loses electrons, so it is left with more positive charge than negative charge.** **3**

electrons are transferred (by friction) (1)
from the cloth to the rod (1)
the cloth has lost electrons, so it has more positive charge than negative charge (1)
Any reference to positive charges / protons moving scores a maximum of 1 mark.

07.1 **Answer: Fill the can until water runs out of the spout; when it stops, lower the stone in and collect the displaced water in a measuring cylinder; the volume collected is the volume of the stone.** **3**

fill the displacement can with water until it overflows from the spout, and wait until it stops dripping (1)
lower the stone gently into the can and collect the water that flows out in a measuring cylinder (1)
the volume of water collected equals the volume of the stone (1)
Allow a method that reads the change in level of water in a measuring cylinder when the stone is added, for a maximum of 2 marks.

07.2 **Answer: 2700 kg/m^3** **3**

density = 54.0 ÷ 20.0 (1)
= 2.70 (g/cm^3) (1)
= 2700 (kg/m^3) (1)
Allow conversion first: 0.0540 kg ÷ 0.0000200 m^3 = 2700 kg/m^3 for 3 marks. An answer of 2.70 with no unit or with g/cm^3 scores 2 marks.

07.3 **Answer: 2.7 × 10^5 J** **2**

E = 0.12 × 2.26 × 10^6 (1)
E = 2.7 × 10^5 (J) (1)
Allow 271 200 J or 270 000 J. An answer of 2.7 × 10^5 J with no working scores 2 marks.

07.4 **Answer: The particles move faster, so they collide with the walls more often and with more force, so the force per unit area increases.** **3**

the (average) kinetic energy / speed of the particles increases (1)
the particles collide with the walls of the container more often / more frequently (1)
each collision exerts a greater force, so the force per unit area (pressure) increases (1)
Do not accept 'the particles expand' or 'the particles collide with each other more'. Do not accept 'more particles'.

07.5 **Answer: 300 kPa** **2**

100 × 240 = p × 80 (1)

p = 300 (kPa) (1)

Allow 300 000 Pa or 3.0 × 10^5 Pa. An answer of 33 kPa (inverted ratio) scores 1 mark.

08.1 **Answer: $^{218}_{84}$Po** **2**

mass number 218 (1)

atomic number 84 (1)

08.2 **Answer: $^{14}_{6}C \rightarrow {}^{14}_{7}N + {}^{0}_{-1}e$** **2**

$^{14}_{7}$N (1)

$^{0}_{-1}$e (1)

Allow $^{0}_{-1}\beta$ for the beta particle. Allow 14/7 N and 0/−1 e written without superscripts or subscripts if the numbers are clearly placed.

08.3 **Answer: A neutron changes into a proton and an electron; the electron is emitted at high speed.** **2**

a neutron changes / turns into a proton (1)

and an electron, which is emitted (as a high-speed electron) (1)

Do not accept 'an electron leaves an orbit / shell'.

08.4 **Answer: 4 hours** **1**

4 (hours) (1)

08.5 **Answer: 25 Bq** **2**

24 hours = 6 half-lives (1)

activity = 1600 ÷ 2^6 = 25 (Bq) (1)

Allow ecf from 08.4. An answer of 25 Bq with no working scores 2 marks.

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

Level 3 (5–6 marks): A clear, logical evaluation that compares the isotopes using both the type of radiation and the half-life, explains why each unsuitable isotope is rejected, and reaches a justified conclusion that X is the most suitable.

Level 2 (3–4 marks): The type of radiation and/or the half-life are used to reject at least one isotope and to support a choice, but the reasoning is incomplete or one factor is not explained.

Level 1 (1–2 marks): Simple, relevant statements about the isotopes or about alpha, beta or gamma radiation, with little or no reasoning. A choice without reasoning scores no more than 1 mark.

0 marks: No relevant content.

Indicative content:

• the radiation must pass out of the body to reach the detector

• gamma radiation is the most penetrating, so it passes out of the body

• gamma radiation is the least ionising, so it does least damage to cells inside the body

• W emits alpha: it would be absorbed inside the body, so it would not be detected outside

• alpha is strongly ionising, so W would be very damaging to cells inside the body

• Z emits beta: it is partly absorbed by tissue and is more ionising than gamma

• Z's half-life of 14 days is long, so the patient is exposed for a long time

• Y emits gamma, but its half-life of 30 years means it stays radioactive in the body

for a very long time
• X emits gamma and has a half-life of 6 hours
• 6 hours is long enough for the tracer to travel through the body and for images to be taken
• but short enough that the activity falls to a low level quickly, so the patient receives a small dose
• conclusion: X is the most suitable isotope
Choosing X with no reasoning scores 1 mark. An answer that chooses Y because 'it lasts longer' can still reach Level 2 if the properties of radiation are used correctly.

09.2 **Answer: Contamination is the unwanted presence of radioactive atoms on or in a material; irradiation is exposure to nuclear radiation, and the object does not become radioactive.** **2**

contamination: the unwanted presence of materials containing radioactive atoms on or in other materials (1)
irradiation: exposing an object to nuclear radiation; the object does not become radioactive (1)

09.3 **Answer: A neutron is absorbed by a uranium-235 nucleus, which splits into two smaller nuclei and releases two or three neutrons and energy; the released neutrons cause further fission.** **3**

a neutron is absorbed by a large, unstable nucleus, e.g. uranium-235 or plutonium-239 (1)
the nucleus splits into two smaller nuclei, releasing two or three neutrons (and energy / gamma rays) (1)
the released neutrons are absorbed by other nuclei and cause further fission events (1)
Do not accept 'atoms split' for the second mark if no nucleus is mentioned anywhere in the answer. Ignore references to control rods.

Total: 100 marks