GCSE Physics: Energy & electricity

Higher-tier practice for AQA 8463, Edexcel 1PH0 and OCR J249. Covers energy efficiency, specific heat capacity, circuits, electromagnetism and space physics. Formula sheet provided in exams for 2025–2027 sittings. Mark scheme on page 2.

England | Higher tier | AQA / Edexcel / OCR | A4 · 2 pages

EQUATIONS PROVIDED (2025–2027 FORMULA SHEET)

You do not need to memorise: V = IR; P = VI; efficiency = useful output ÷ total input; $\Delta E = mc\Delta\theta$; E = Pt; $v = f\lambda$; momentum p = mv; F = BIl; wave speed $v = f\lambda$. Recall from memory: F = ma; W = mg; P = E/t; Newton's laws.

QUESTIONS

Q1 ★ · Ohm's law (1 mark)

A resistor has a current of 2 A through it when the potential difference across it is 6 V. What is its resistance?

A) 0.33 Ω B) 3 Ω C) 8 Ω D) 12 Ω

Circle your answer: A B C D

Q2 ★★ · Energy efficiency (2 marks)

A lamp transfers 60 J of electrical energy each second. Of this, 9 J is transferred usefully as light. Calculate the efficiency of the lamp as a percentage.

Q3 ★★★ · Specific heat capacity (5 marks · required practical)

A student heats a 0.50 kg aluminium block with a 50 W immersion heater. Temperature recorded every 60 s:

TIME (S)	0	60	120	180	240
Temp (°C)	20	23	26	29	32

(a) Calculate the energy supplied by the heater in the first 240 s. (2 marks)

(b) Use your answer to estimate the specific heat capacity of aluminium. (2 marks)

(c) The accepted value is 900 J/kg°C. Suggest one reason the experimental value is higher. (1 mark)

MA

Q1 · Ohm's law

ANSWER: **B (3 Ω)**. R = V / I = 6 / 2 = 3 Ω [1 mark]

Q2 · Efficiency

Efficiency = useful output / total input = 9 / 60 [M1] = **0.15 = 15%** [A1]. Accept 0.15 or 15%.

Q3 · Specific heat capacity

(a) E = P × t = 50 × 240 [M1] = **12 000 J** [A1]

(b) ΔT = 30 − 20 = 10°C; c = E / (m × ΔT) = 12 000 / (0.50 × 10) [M1 substitution, ECF from (a)] = **2400 J/kg°C** [A1, ECF]

(c) Any one of: energy was lost to the surroundings rather than all going into the block; heat was absorbed by the container or thermometer; the block was not insulated / lagged. [1 mark]. Do not accept 'human error' alone.

Q4 · Forces and motion

(a) a = (v − u) / t = (24 − 0) / 8.0 [M1] = **3.0 m/s^2** [A1, unit required].

(b) F = ma = 1200 × 3.0 [M1, ECF from (a)] = **3600 N** [A1, unit required].

Q5 · Red-shift and the Big Bang (6 marks, levelled)

Level 3 (5–6): correct definition of red-shift AND a clear chain: greater red-shift → faster recession with distance → expanding Universe → Big Bang (traced backwards from expansion to single hot dense point).

Level 2 (3–4): mostly correct but chain incomplete (e.g. defines red-shift and links to recession but doesn't link to Big Bang, or links to Big Bang without reasoning from red-shift).

Level 1 (1–2): basic statement, e.g. 'red-shift means the galaxy is moving away', with little further linkage.

Model answer: Red-shift is the increase in observed wavelength of light from a galaxy compared with its source, shifting it towards the red end of the spectrum. It happens because the galaxy is moving away from us. More distant galaxies show greater red-shift, meaning they are receding faster, which shows the whole Universe is expanding. Working this expansion backwards suggests everything began from a single hot, dense point: the Big Bang.