Level 2 Physics: practice paper 2026

AS 91173 Demonstrate understanding of electricity and electromagnetism · Vertex Academy practice paper, not an NZQA paper

Attempt ALL the questions. Show ALL working. Write your answers on lined paper, or in the space under each question.

QUESTION ONE

(a) Two parallel metal plates in a school lab are 0.020 m apart, with 500 V across them.
Use $E = V \div d$.
Calculate the electric field strength between the plates.

(b) An electron (charge 1.6×10^{-19} C) is between the plates of part (a), where the field strength is 2.5×10^{4} V m^{-1}.
Use $F = Eq$.
Calculate the size of the force on the electron and state its direction.

(c) The electron in part (b) starts at rest at the negative plate and moves all the way across the 0.020 m gap to the positive plate. The field strength is 2.5×10^{4} V m^{-1}.
Use $\Delta Ep = Eqd$.
Calculate the energy the electron gains crossing the gap, and explain why the force on it is the same everywhere between the plates.

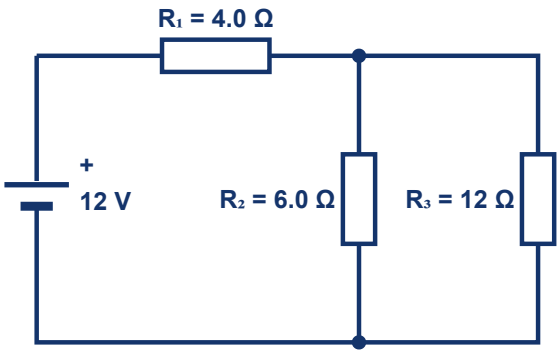
(d) In a version of Millikan's experiment, an oil drop of mass 3.2×10^{-15} kg floats at rest between two horizontal plates 0.020 m apart when the voltage across them is 980 V. The drop carries extra electrons (each 1.6×10^{-19} C).
Use $F = mg$ with $g = 9.8$ m s^{-2}, $E = V \div d$ and $F = Eq$.
Calculate the charge on the drop and how many extra electrons it carries, and state which plate must be positive. Explain what happens to the drop if the voltage is increased.

QUESTION TWO

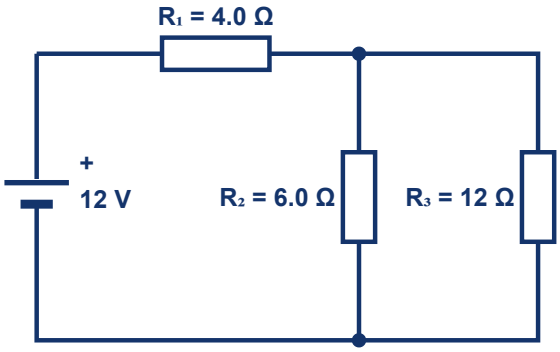
(a) A heater circuit has a 12 V battery, a 4.0 Ω resistor R_1 in series, and then two resistors in parallel: R_2 = 6.0 Ω and R_3 = 12 Ω. The connecting wires and battery have no resistance.

Use $\frac{1}{Rp} = \frac{1}{R_2} + \frac{1}{R_3}$, and add resistances in series.

Calculate the total resistance of the circuit.



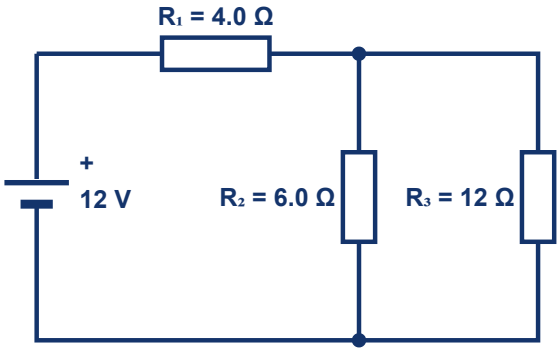
(b) The circuit in the diagram has a 12 V battery and a total resistance of 8.0 Ω.
Use V = IR.
Calculate the current from the battery.



(c) In the circuit in the diagram, 1.5 A flows from the 12 V battery.

Use $V = IR$ and $P = I^2R$.

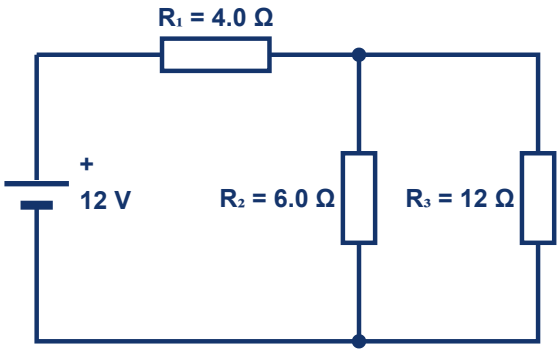
Calculate the voltage across the parallel pair, the current in each of R_2 and R_3, and the power in R_1.



(d) In the circuit in the diagram, R_3 (12 Ω) burns out and stops conducting. Before that, the power in R_1 was 9.0 W and the power in R_2 was 6.0 W.

Use $V = IR$ and $P = I^2R$.

Calculate the new power in R_1 and in R_2, and explain why one goes up and the other goes down.



QUESTION THREE

(a) A 0.25 m length of wire in a model motor carries a current of 3.0 A due north. It sits in a magnetic field of 0.40 T that points vertically downwards.

Use $F = BIL$.

Calculate the size of the force on the wire and state its direction.

(b) A proton (charge 1.6×10^{-19} C) moves at 2.0×10^{6} m s^{-1} at right angles to a magnetic field of 0.50 T.

Use $F = Bqv$.

Calculate the force on the proton.

(c) A metal rod 0.30 m long slides at a steady 4.0 m s^{-1} along two metal rails, at right angles to a magnetic field of 0.60 T. The rails are joined at one end, so the rod is part of a circuit with a total resistance of 1.8 Ω.

Use V = BvL and V = IR.

Calculate the voltage induced across the rod and the current in the circuit, and explain why a voltage is induced.

(d) The rod in part (c) (0.30 m long, moving at 4.0 m s^{-1} in 0.60 T) carries an induced current of 0.40 A.

Use F = BIL and P = Fv and P = VI.

The induced current makes the field push on the rod. Calculate this force and explain its direction.

Show that the power needed to keep the rod moving at a steady speed equals the electrical power in the circuit, and explain what this shows.

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