7 (a) A straight piece of wire is 0.713 m long.

It is placed at right angles to a uniform magnetic field of 0.47 T.

The force on the wire is 0.089 N.

Calculate the current in the wire.

Use an equation from the formula sheet. Give your answer to an appropriate number of significant figures.

(2)

current = ... A

(b) A student investigates the relationship between the magnetic flux density and the electromagnetic force on a current-carrying wire.

The student has the equipment shown in Figure 19.

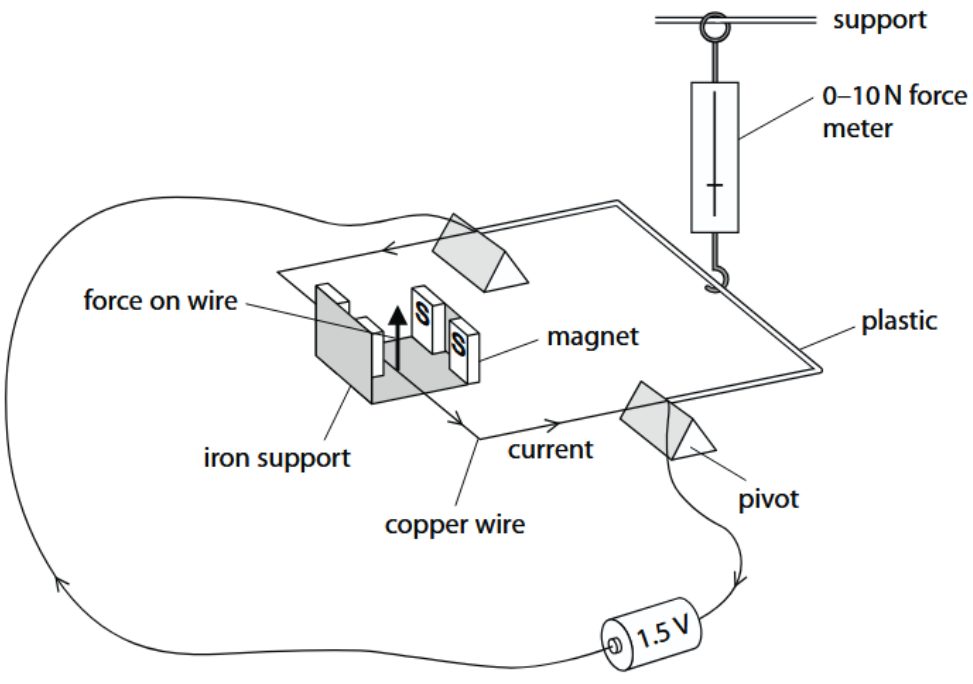

Figure 19

The student varies the number of magnets and measures the force on the wire using the force meter.

The results are shown in Figure 20.

number of pairs of magnets	reading on force meter (N)
1	0.0
2	0.0
3	0.1

Figure 20

The student decides that his equipment is not sufficiently sensitive.

Give **three** ways the student should develop his investigation to improve the quality of his results.

(3)

1 .....

.....

2 .....

.....

3 .....

.....

(c) Figures 21 and 22 show different voltages that can be applied across a wire.

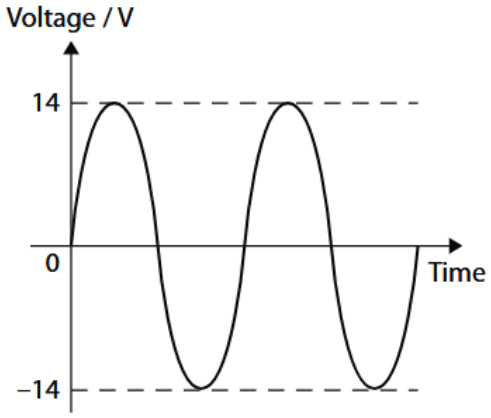

Figure 21

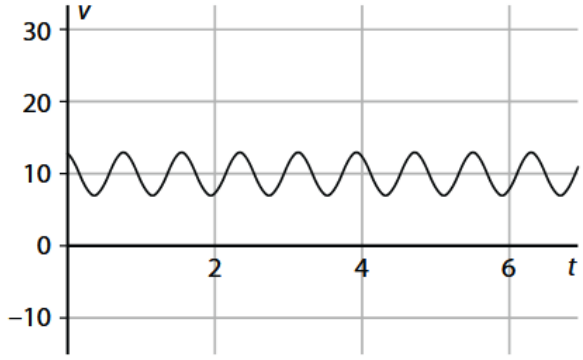

Figure 22

Explain which of the voltages in Figures 21 and 22 cause an a.c. current in the wire.

(2)

(d) A power transmission wire hangs so that it is at right angles to the Earth's magnetic field.

Although this magnetic field is constant, the cable experiences a changing force.

Explain why the force experienced by the cable changes.

(4)

(Total for Question 7 = 11 marks)

Question number	Answer	Additional guidance	Mark
7(a)	substitution into correctly rearranged equation (1) $I = \frac{F}{B} \times l$ $= \frac{0.089}{0.47} \times 0.713$ evaluation to 2 s.f. (1) current = 0.27 (A)	give full marks for correct numerical answer without working	**(2)**

Question number	Answer	Additional guidance	Mark
7(b)	Any three from: • use a higher current as the force depends on the current (1) • use more/stronger/larger range of magnets (1) • use a force meter with smaller range, e.g. 0.00 to 0.01 (1) • use a longer distance from pivot to increase the moment of the force on the wire (1)	accept voltage for current add variable resistor (in series) with power supply accept use more sensitive force meter	**(3)**

Question number	Answer	Mark
7(c)	An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (1 mark): • if the voltage changes sign, then the current is changing direction • so in Figure 21 the current is a.c. as the voltage is changing sign and in Figure 22 the current is d.c. as the voltage is always positive	**(2)**

Question number	Answer	Additional guidance	Mark
7(d)	An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (3 marks): • the transmission wire carries an alternating current (1) • the force is caused by this current which varies in size and direction (1) • the direction of this force depends on the direction of the current so the direction of the force also changes (1) • the magnitude of this force depends on the magnitude of the current so the magnitude of the force also changes (1)	allow responses that link the changes in the force to the interaction of the changing field around the wire with the constant field of the Earth	**(4)**