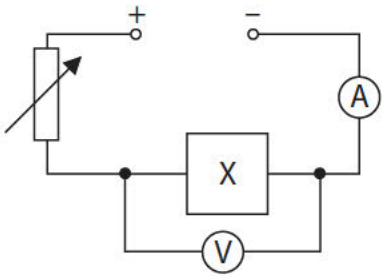
1 A student is given an unknown electrical component, X.

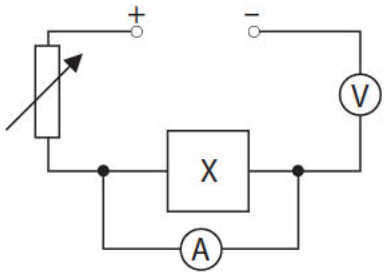
He uses a circuit to investigate how the current in X varies with the voltage across it.

(a) Which of these circuits is correct for his investigation?

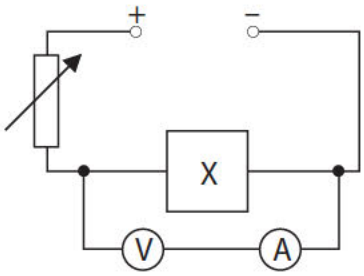
(1)



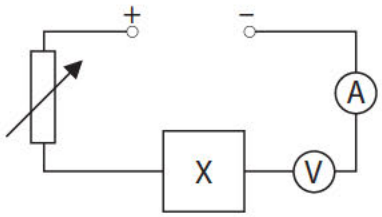
A ☒



B ☒



C ☒



D ☒

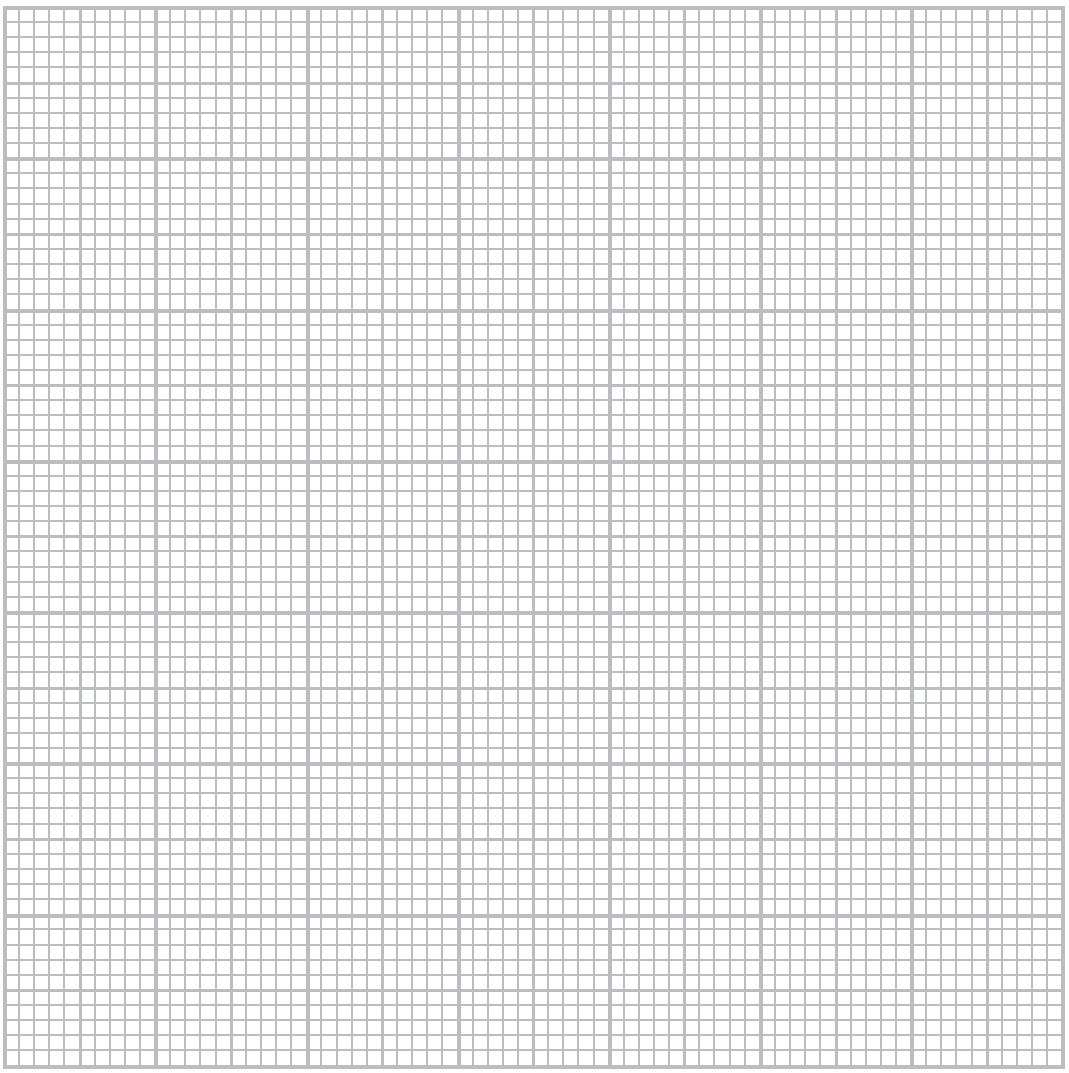
(b) The table shows the student's results.

Voltage across X in V	Current in X in A
0	0
3.0	0.5
14.5	2.3
19.5	2.9
25.0	3.2
29.5	3.3

(i) Plot a graph of these results and draw a curve of best fit.

(4)

current in A



voltage in V

(ii) State the equation linking voltage, current and resistance.

(1)

(iii) Calculate the resistance of component X when the voltage across it is 10.0 V.

Give the unit.

(4)

resistance = ... unit .....

(iv) Describe the pattern shown by this graph.

(3)

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(v) Suggest a conclusion for the investigation.

(2)

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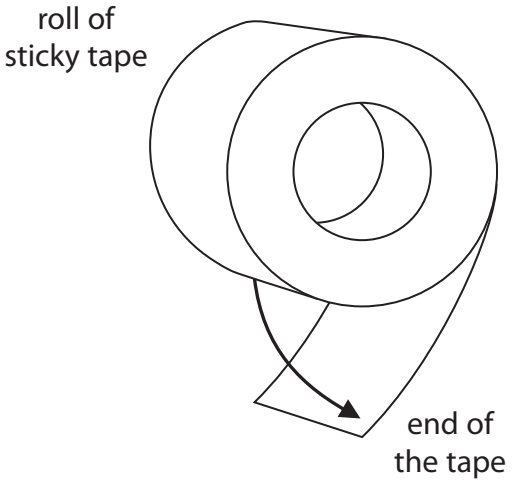
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(Total for Question 1 = 15 marks)

2 A student holds a roll of sticky tape and pulls the end down as shown in the diagram.

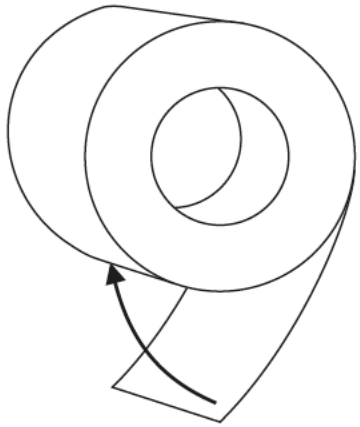


This causes both the roll and the end of the tape to become electrically charged by friction.

(a) Explain how an object becomes charged by friction.

(3)

(b) The student lets go of the end of the tape and the charges cause it to move towards the roll.



Explain why the end of the tape moves back towards the roll.

(2)

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(Total for Question 2 = 5 marks)

3 A wind turbine generates electricity for the National Grid.



(a) The useful energy transfer in the wind turbine is

(1)

- ☒ **A** chemical energy to electrical energy
- ☒ **B** gravitational potential energy to electrical energy
- ☒ **C** kinetic energy to electrical energy
- ☒ **D** sound energy to electrical energy

(b) The generator in the wind turbine transfers 39 MJ of energy in 1 minute.

The generator current is 490 A.

(i) Calculate the output voltage of the generator.

(3)

Voltage = ... V

(ii) The generator output voltage is then increased to 132 kV for transmission.

Explain why electrical energy is transmitted using very high voltages.

(4)

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(c) The generator provides a direct current (d.c.).

This d.c. is changed to an alternating current (a.c.).

The frequency of the alternating current is 50 Hz.

(i) Explain the meaning of **50 Hz alternating current**.

(2)

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(ii) Explain why the d.c. from the generator must be changed to a.c. before it is transmitted.

(2)

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(Total for Question 3 = 12 marks)

4 Some energy sources are renewable and other energy sources are non-renewable.

a) (i) Explain what is meant by the term non-renewable.

(1)

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(ii) Give an example of a non-renewable energy source.

(1)

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(b) The photograph shows a wind farm that generates electricity for the National Grid.



(i) Some wind farms are in remote areas.

Explain how the electrical energy from a remote wind farm is transmitted to large cities.

(3)

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(ii) Some people think that wind farms are a good idea.

Others disagree.

Discuss the advantages and disadvantages of building more wind farms.

(6)

(Total for Question 4 = 11 marks)