OCR GCSE GATEWAY PHYSICS A · J249

PHYSICS



EXAM QUESTION PACK

P3.2 SIMPLE CIRCUITS

SCORE	PERCENTAGE
/264	%

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Gateway Physics A (9-1)

Simple circuits

Please note that you may see slight differences between this paper and the original.

Candidates answer on the Question paper.

OCR supplied materials:
Additional resources may be supplied with this paper.

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: Not set

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **264**.
- The total number of marks may take into account some 'either/or' question choices.

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1 Voltage is increased before transmission through the National Grid.

It is increased from 25 000 V up to 400 000 V. This increases the voltage 16 times.

(i) How much would this increase in voltage affect the current?

---

[2]

(ii) Use the formula: **power = current^2 × resistance**

to explain why this voltage increase is important to power loss in transmission cables.

---

[2]

2(a) Elin has some electrical appliances in her home.

She switches them on and measures how long they are used for.

She records some information about four appliances.

Look at the table.

Appliance	Average power in watts	Voltage in volts	Current in amps	Time appliance used in hours
Grill	1500	230		0.5
Oven	1800	230		5
Laptop charger	100	20		1
Slow cooker	460	230		4

Which appliance uses the highest current?

Appliance _____

Calculate the current for this appliance.

Answer (to two decimal places) _____ A

[3]

(b) Elin buys her electricity from an energy company.

This company charges 18 pence per kWh unit for electricity.

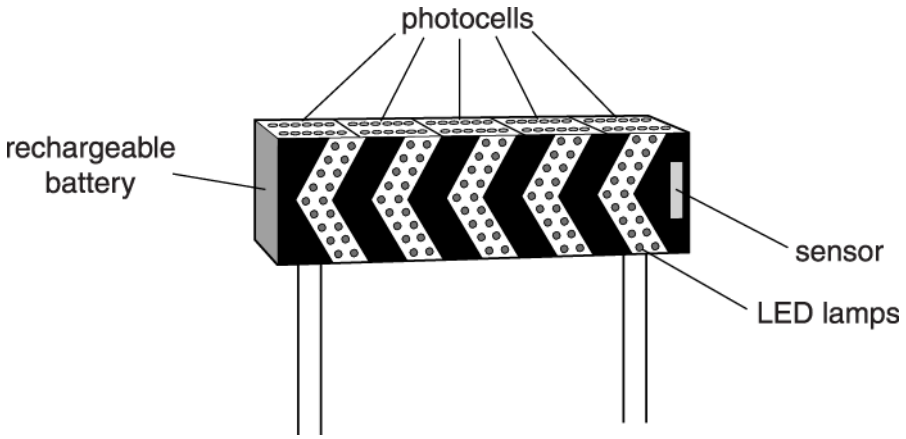
What is the cost of using the grill for 20 hours?

Answer _____ pence

[2]

3(a) Photocells can be used to supply electricity for road signs.

Look at the diagram of a road sign below.



This road sign is in the countryside. It is not connected to mains electricity.

When the sensor detects a car approaching, the LEDs in the road sign light up and flash.

One advantage of using photocells is that they are able to power this road sign even in a remote location.

Write down two other advantages of using photocells for this road sign.

1

2

---

[1]

(b) Describe how the light produces electricity in the photocells.

---

[2]

(c) The photocells are fixed on the top of the road sign.

The photocells cannot move to point in the direction of the Sun.

Instead of using photocells which move, the road sign has a large area of photocells.

Explain why there needs to be a large area of photocells.

---

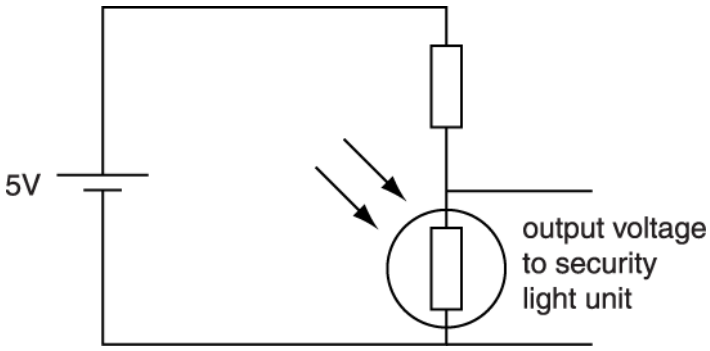
[2]

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4 Felippe has a security light which turns on when it becomes dark.

An LDR can be used as part of a potential divider circuit to turn on the security light.

Look at the diagram.



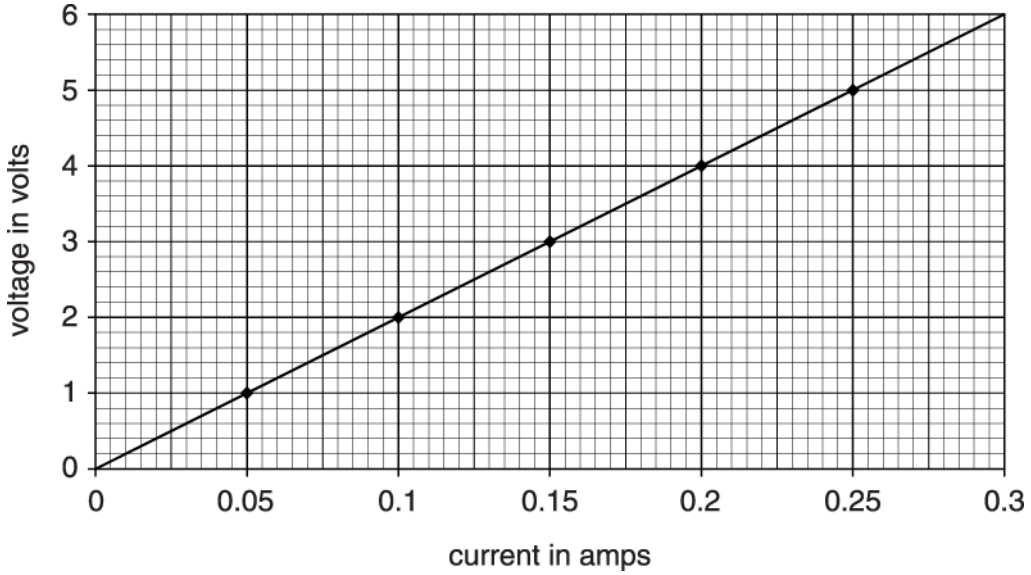
Explain how the potential divider circuit and the LDR can be used to turn on the security light when it becomes dark.

The quality of written communication will be assessed in your answer to this question.

[6]

5(a) Anna investigates how the current through a resistor changes with voltage.

She plots her results on a graph.



What is the resistance of the resistor that Anna used?

---

answer _____ Ω **[2]**

(b) Anna replaces the resistor with one that has 3 times the resistance value.

Describe, and explain, how the gradient of the graph would change.

---

[2]

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6 The National Grid transfers power from power stations to homes and factories.

The current in a circuit which is part of the National Grid is 100 A.

The resistance of this part of the circuit is 200 Ω.

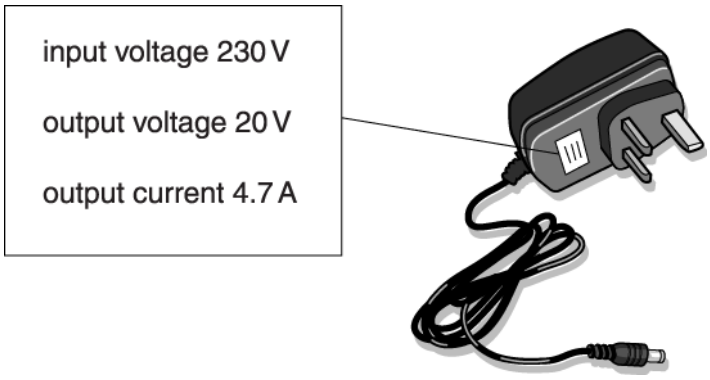
Calculate the power loss in this part of the circuit in MW.

answer _____ MW **[2]**

7 Victoria lives in the UK.

She buys a new computer.

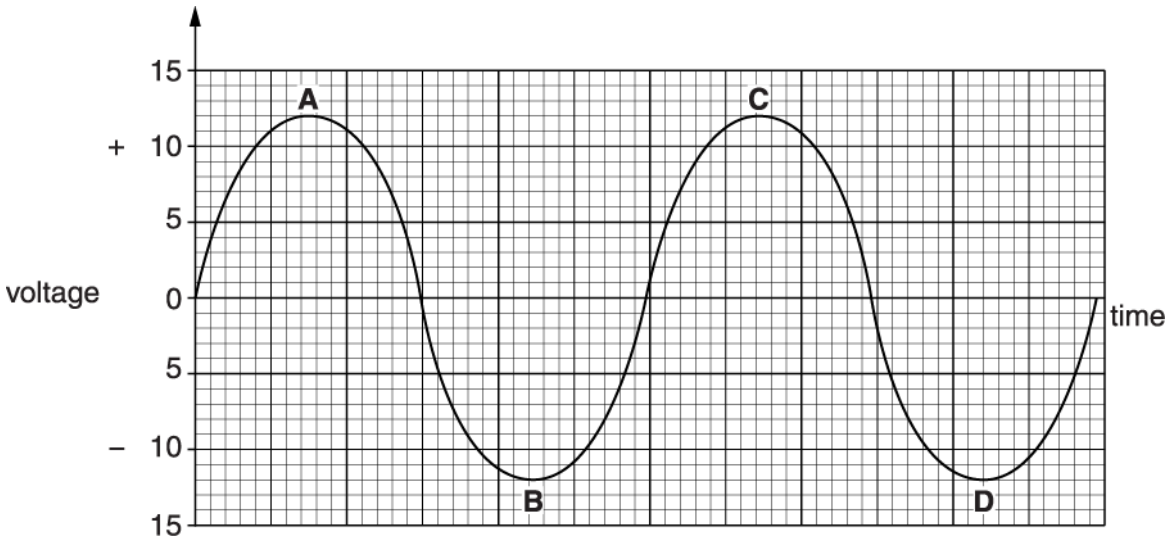
Look at the label on the adapter for the computer.



Calculate the **output power** of the adapter.

Output power _____ W **[2]**

8 Look at the graph.



(i) State the maximum (peak) voltage of this AC supply.

_____ V [1]

(ii) A diode can be used to produce half-wave rectification of this AC supply.

Explain how a diode produces half-wave rectification.

Use the letters, **A**, **B**, **C** and **D** on the graph to help you answer.

_____

_____

_____

_____ [2]

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9 Victoria lives in the UK.

Victoria notices that different countries have different **input voltages** for home appliances.

Look at the information she finds on the internet.

Country	Input voltage in V
Bermuda	120
Kenya	240
Japan	100
Mexico	127
UK	230

Victoria has a travel iron.

The input voltage to the iron varies for different countries.

The iron is designed to keep the current the same in each country.

(i) In which country does the iron have the most electrical power?

Explain your answer.

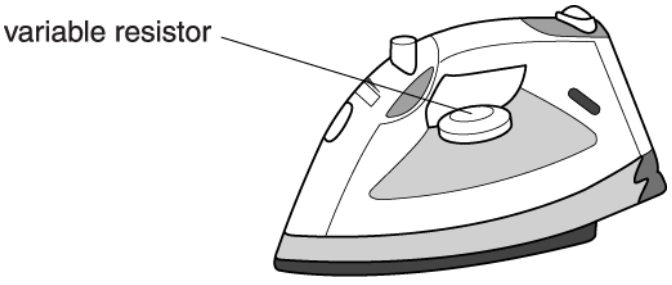
---

[1]

(ii) Victoria's travel iron is not very good at getting creases out of clothes when she uses it in Japan.

She buys a different travel iron with a variable resistor.

Look at the picture of the different travel iron.



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She uses the variable resistor in the iron to change the current.

She now finds that the new iron is more effective at getting rid of creases when she uses it in Japan.

Use the information in the question to explain why.

---

[2]

10 Filament bulbs are used to provide light in some homes and factories.



When the bulb is switched on, the resistance of the filament changes.

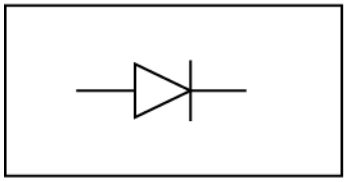
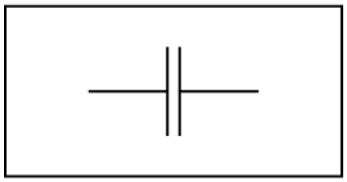
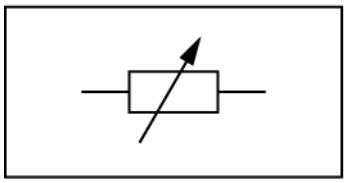
Explain how the resistance of the filament changes when a current passes through it.

Use ideas about atoms and electrical current to explain why this happens.

The quality of written communication will be assessed in your answer to this question.

[6]

11 Draw a line from each **circuit symbol** below to its correct **name**.

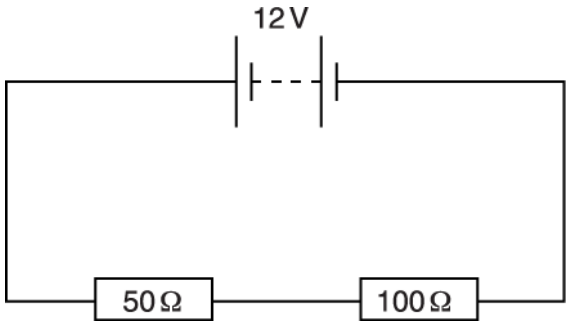
circuit symbol	name
	capacitor
	diode
	variable resistor

[2]

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12(a) Kevin connects a circuit with two resistors in series.

Look at the diagram.

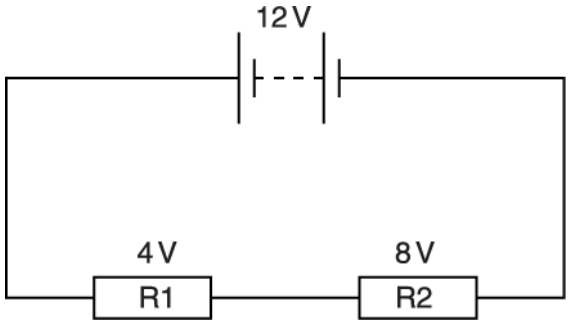


Jean says that Kevin could replace the two resistors with one resistor.

What value of resistor could Kevin use to give the same total resistance?

answer _____ ohms **[1]**

(b) Kevin needs to split the output of the 12 V battery between resistor R1 and resistor R2.



He needs 4 V across R1 and 8 V across R2.

He has four different pairs of resistors, **A**, **B**, **C** and **D** to choose from.

Pairs of resistors	R1 in ?	R2 in ?
A	50	200
B	50	100
C	50	50
D	50	25

Which pair of resistors, **A**, **B**, **C** or **D**, should he use?

Explain your answer.

--- [2]

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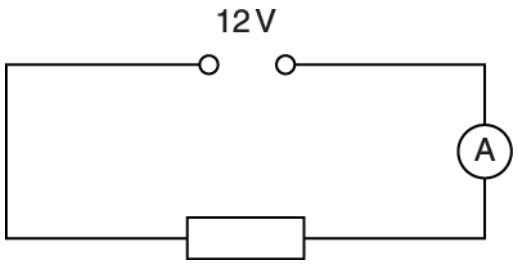
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(c) Kevin needs a resistor of at least 5 ohms.

He finds a resistor without a value on it.

He decides to connect a circuit so that he can calculate the value of the resistor.

Look at the diagram.



The ammeter shows a current of 3 A.

Use a calculation to find out if this resistor is suitable.

---

resistance = _____ ohms

Is this resistor suitable? _____

[2]

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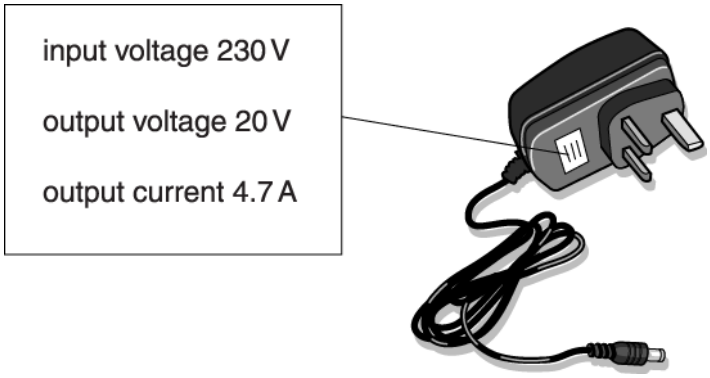
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13(a) Victoria lives in the UK.

She buys a new computer.

Look at the label on the adapter for the computer.



Calculate the **output power** of the adapter.

Output power _____ W **[2]**

(b) Victoria notices that different countries have different **input voltages** for home appliances.

Look at the information she finds on the internet.

Country	Input voltage in V
Bermuda	120
Kenya	240
Japan	100
Mexico	127
UK	230

Victoria has a travel iron.

The input voltage to the iron varies for different countries.

The iron is designed to keep the current the same in each country.

(i) In which country does the iron have the most electrical power?

_____

Explain your answer.

_____

_____ [1]

(ii) The travel iron is not very good at getting the creases out of clothes when used in Japan.

Use the information in the table to explain why.

_____

_____

_____ [2]

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14 Elin has some electrical appliances in her home.

She switches them on and measures how long they are used for.

She records some information about four appliances.

Look at the table.

Appliance	Average power in watts	Voltage in volts	Time appliance used in hours
Grill	1500	230	0.5
Oven	2000	230	5
Phone charger	10	12	1
Slow cooker		230	4

The slow cooker uses an average current of 2 A.

Calculate the average power for the slow cooker.

Answer _____ W

[2]

15 Elin has some electrical appliances in her home.

She switches them on and measures how long they are used for.

She records some information about four appliances.

Look at the table.

Appliance	Average power in watts	Voltage in volts	Time appliance used in hours
Grill	1500	230	0.5
Oven	2000	230	5
Phone charger	10	12	1
Slow cooker		230	4

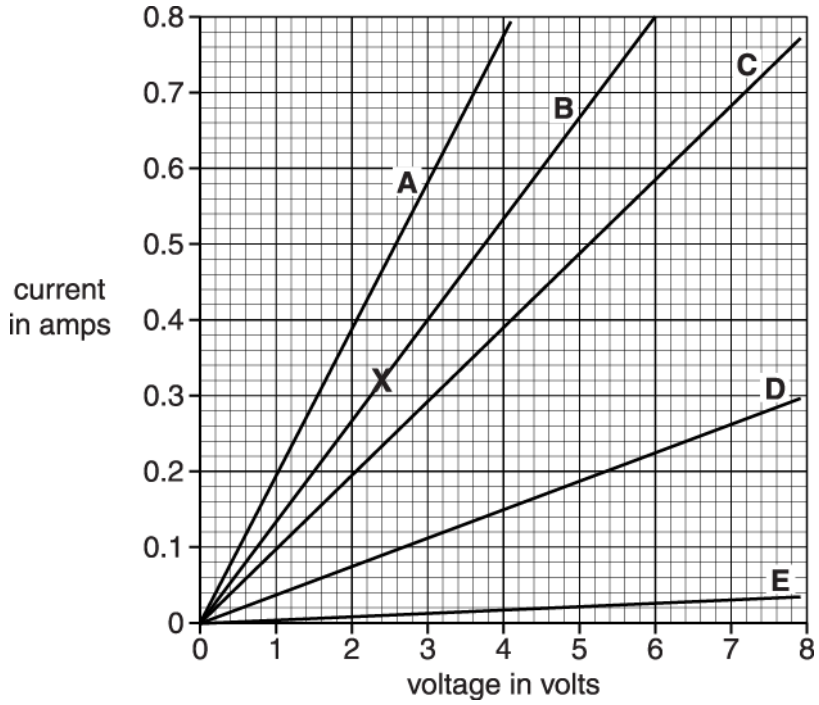
Which appliance costs Elin the most to use?

Appliance _____

Use the data from the table to explain your answer.

---[2]

16(a) George draws a current-voltage graph for five different ohmic conductors.



Ohmic conductors obey Ohm's Law.

Complete the sentence.

All five conductors are ohmic because the lines pass through the origin and _____

[1]

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(b) Look at point **X** on the graph for conductor **B**.

(i) Complete the sentences.

The voltage at **X** is _____ volts.

The current at **X** is _____ amps.

[1]

(ii) Use your answers from (i) to calculate the resistance of conductor **B**.

Choose from

0.13 ohms **0.77 ohms** **2.72 ohms** **7.50 ohms**

answer _____

[1]

(c) Which conductor has the greatest resistance?

Choose from.

A **B** **C** **D** **E**

answer _____

[1]

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(d) When the voltage is more than 6 volts conductor **B** gets hot.

George uses a model to explain resistance:

> Current in a conductor is the flow of charge carriers calledneutrons.
>
> The charge carriers collide with the atoms (ions) in the conductor.
>
> This explains electrical resistance.
>
> As the conductor gets hotter the resistance stays the same.

George has made **two** mistakes.

Describe the two mistakes he has made and write down the corrections.

---

[2]

17(a) Symbols are used to represent electronic components.

Look at the two different symbols.



These electronic components are different types of resistors.

Write down the name of each electronic component **and** what makes their resistance change.

A _____

_____

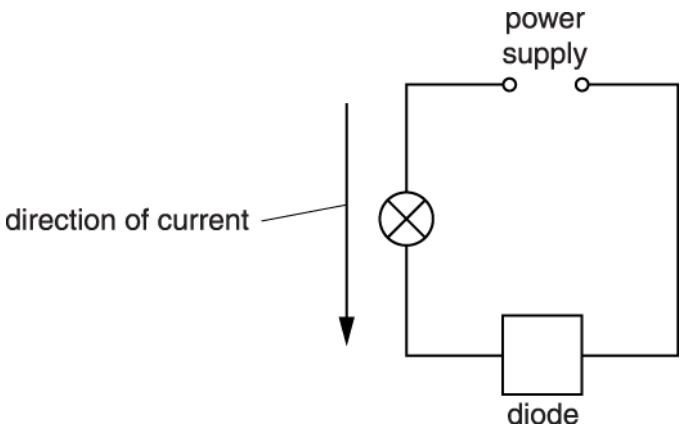
B _____

_____

[3]

(b) Diodes allow a current to pass in only one direction.

Look at the circuit diagram.



In the box labelled diode, draw a diode symbol which allows the current to pass in the direction shown.

[2]

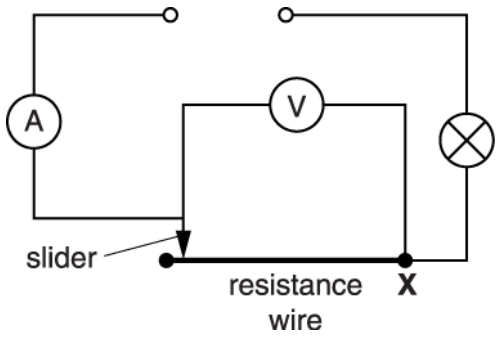
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18 Sheree does an experiment in her science lesson.

Look at a diagram of the circuit she uses.



Sheree moves the slider to different positions along the resistance wire towardsconnection **X**.

This changes the length of the resistance wire in the circuit.

She writes down the readings from the ammeter and the voltmeter.

Look at Sheree's results.

Distance between slider and X in cm	Current in amps	Voltage in volts	Resistance in ohms
40	0.12	0.75	6.25
30	0.15	0.70	4.67
20	0.20	0.60	
10	0.30	0.45	

Calculate the missing values for resistance.

Use the information from the table to describe how current and resistance changewhen the length of the resistance wire is changed.

The quality of written communication will be assessed in your answer to this question.

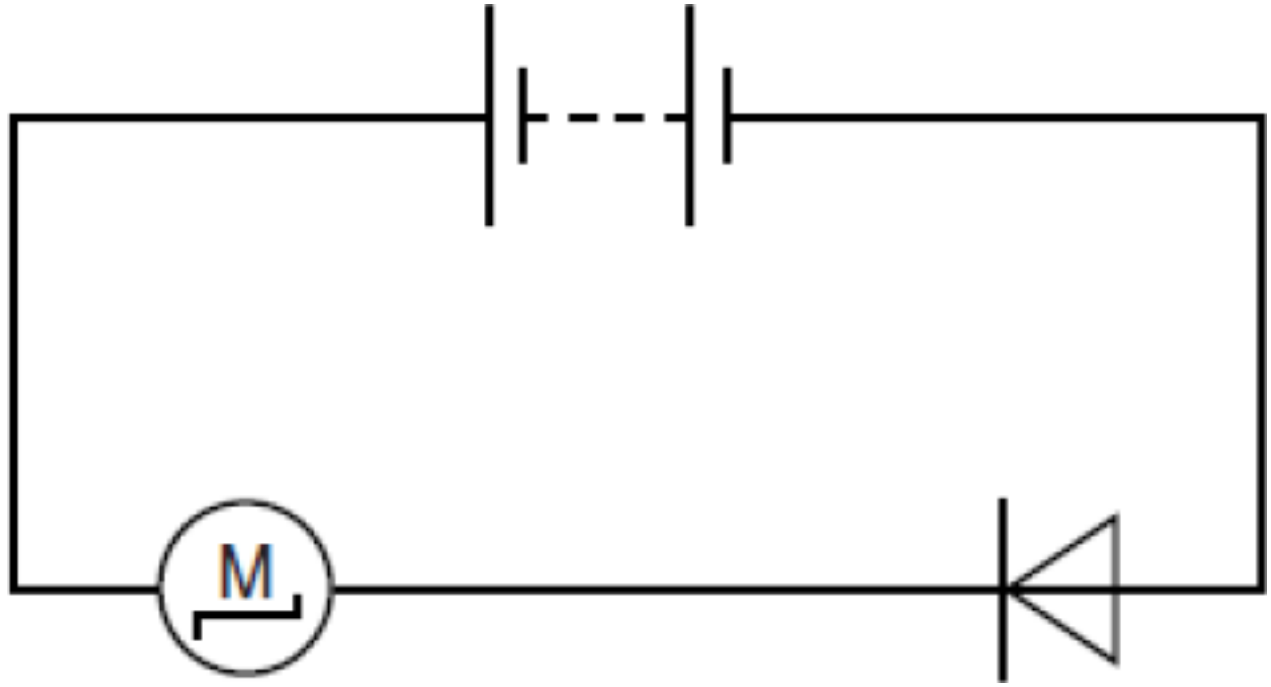
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[6]

19(a) Rob puts a motor in a circuit.



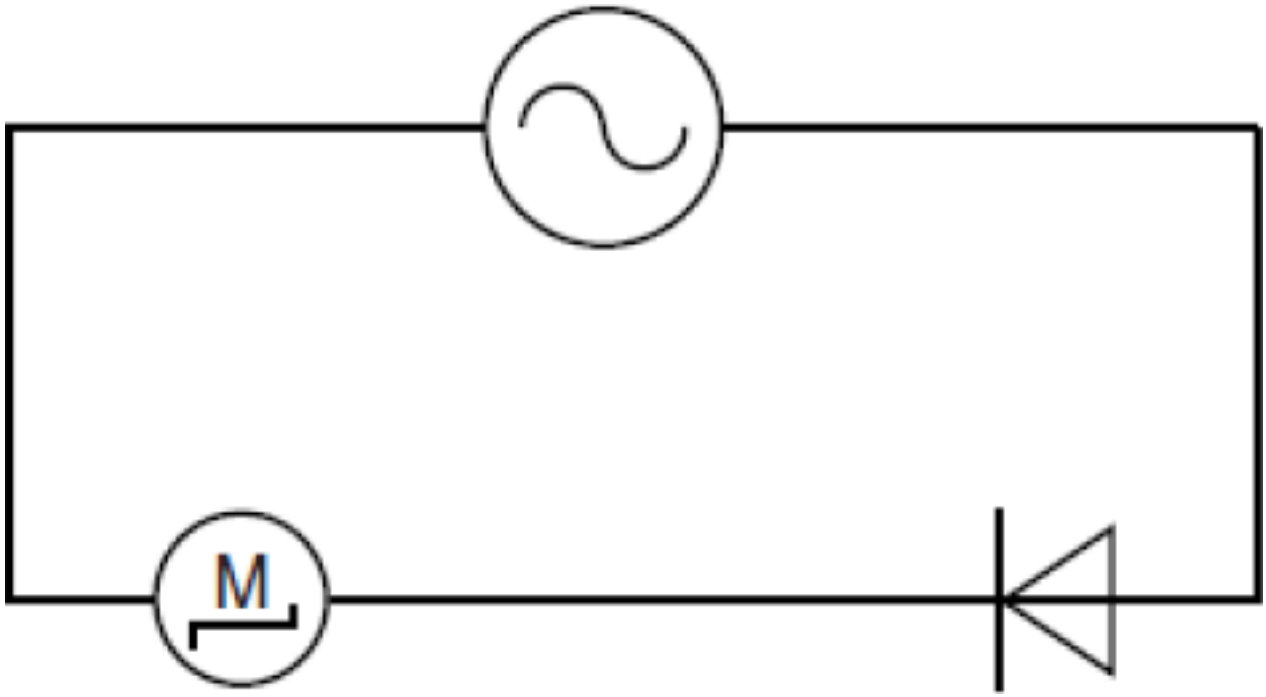
The motor does not turn.

Explain why.

[2]

(b) Rob replaces the battery with an ac supply.

The motor now turns, but not smoothly.



Explain why.

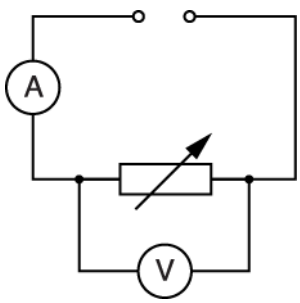
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[1]

20(a) Ksenia and Eva investigate five different variable resistors.

They set each variable resistor to the maximum resistance.

They keep the voltage the same and use this circuit to measure the current.



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Look at their results.

Variable resistor	Reading on ammeter in amps
A	0.12
B	0.15
C	0.16
D	0.06
E	0.11

(i) The maximum resistance for variable resistor **B** is 4.79 ohms.

Calculate the voltage to 2 significant figures.

---

voltage _____ volts

[2]

(ii) During the measurements the voltage was kept constant for all the variable resistors.

Which variable resistor has the **highest** resistance?

Choose from

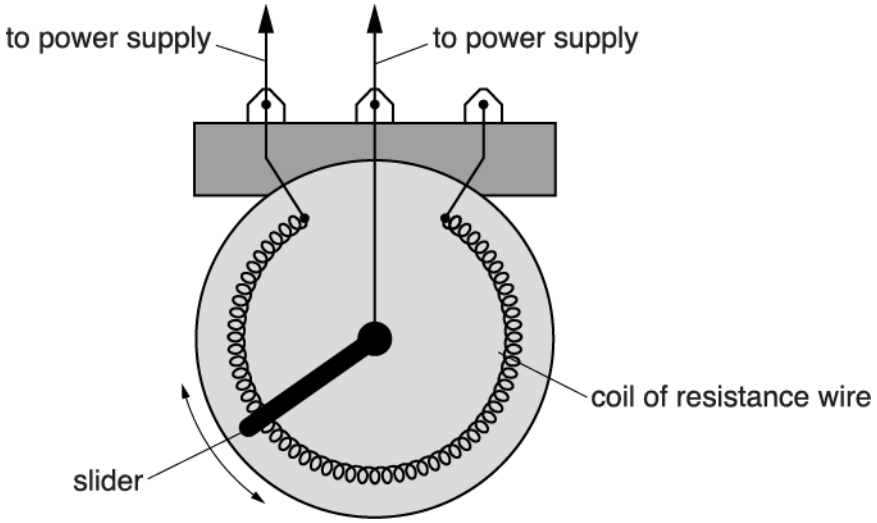
A **B** **C** **D** **E**

---

[1]

(b) Ksenia looks inside a variable resistor.

Look at the diagram.



The slider moves around and keeps in contact with the coil of resistance wire.

Explain how this variable resistor can be moved to increase **and** decrease the current in a circuit.

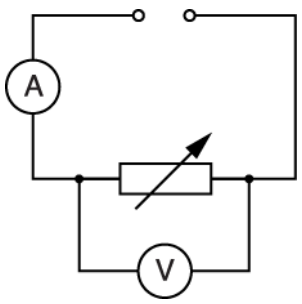
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[2]

21(a) Ksenia and Eva investigate five different variable resistors.

They set each variable resistor to the maximum resistance.

They keep the voltage the same and use this circuit to measure the current.



Look at their results.

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Variable resistor	Current reading on ammeter in amps
A	0.12
B	0.15
C	0.16
D	0.06
E	0.11

All the wires inside the variable resistors are

- made of the same material
- the same thickness.

(i) Which of the five variable resistors in the table has the **longest** wire?

Choose from

A **B** **C** **D** **E**

answer _____ **[1]**

(ii) Which variable resistor will have the **highest** resistance?

Choose from

A **B** **C** **D** **E**

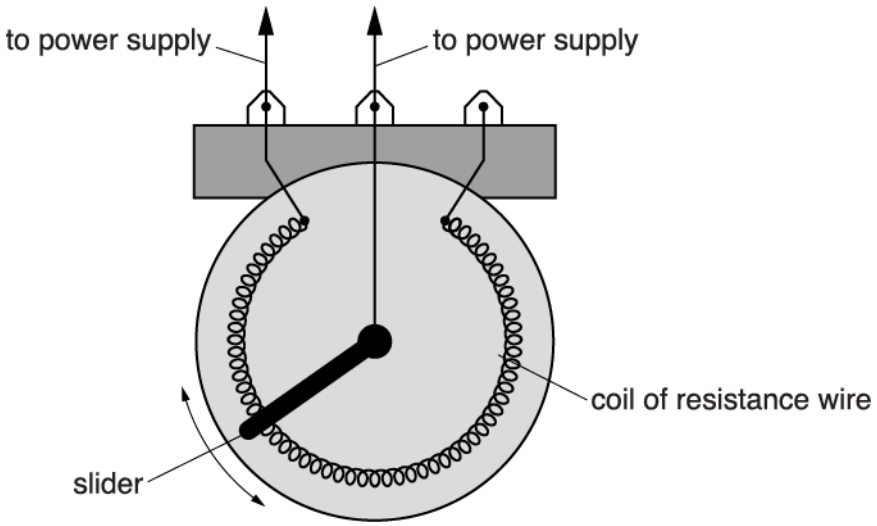
answer _____ **[1]**

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(b) Ksenia looks inside a variable resistor.
Look at the diagram.



The slider moves around touching the coil of resistance wire.

Draw on the diagram where the slider should be to get the **highest** current reading.

[1]

(c) Eva writes down a voltmeter reading for variable resistor **B**.

ammeter reading = 0.15 A
voltmeter reading = 0.70 V

Calculate the resistance of variable resistor **B** to 2 significant figures.

Resistance of variable resistor **B** _____ unit of resistance _____

[3]

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22 The National Grid has many power lines at high voltage.

The National Grid uses two high voltages.

- 4.00×10^5 V
- 2.75×10^5 V

Both voltages are used to transfer 2.0×10^9 W of electrical power.

Calculate the current in the power lines at each voltage and explain why the higher voltage is better for power transmission through the National Grid.

At a voltage of 4.00×10^5 V

answer _____ A

At a voltage of 2.75×10^5 V

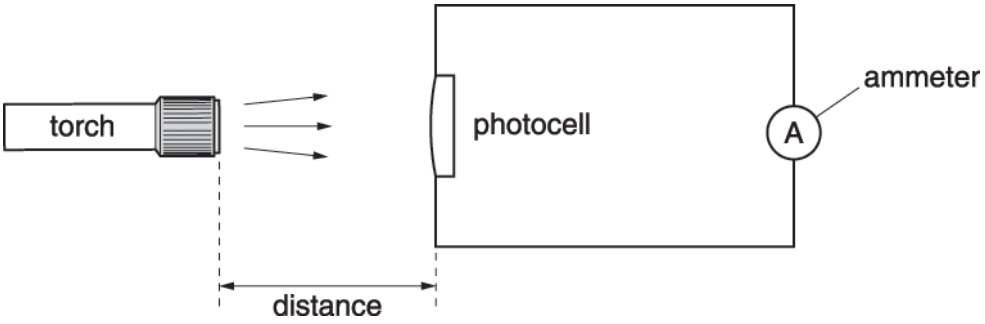
answer _____ A

Explanation

[3]

23 John investigates the current produced by a photocell.

Look at the circuit he uses.



John moves the torch away from the photocell.

This changes the current through the ammeter.

Look at his results.

Distance between torch and photocell in cm	10	20	30	40	50
Current in mA	192	48		12	8

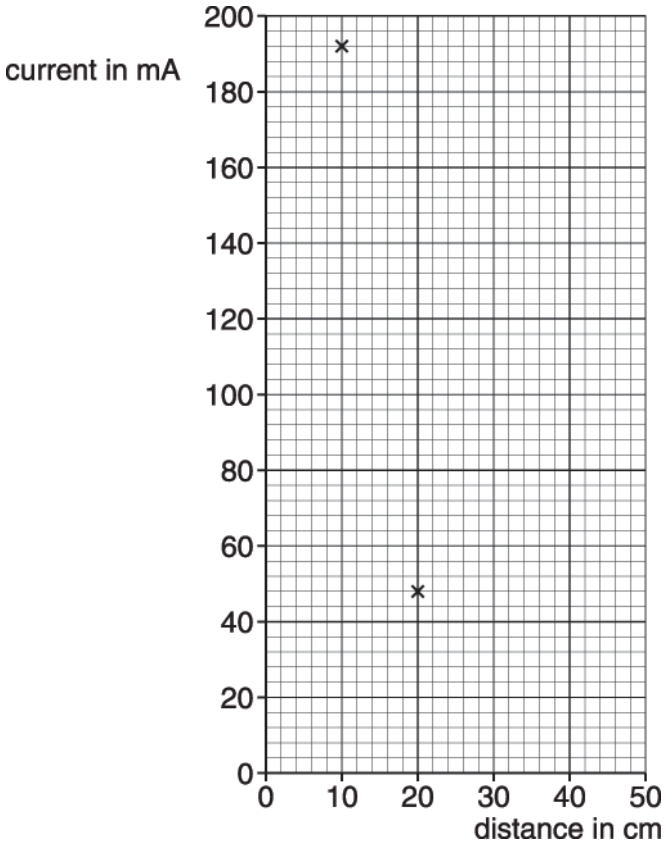
(i) Use the graph to help predict the current in mA for a distance of 30 cm.

The first two results in the table have been plotted for you.

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Current for a distance of 30 cm = _____ mA

[2]

(ii) Write a detailed conclusion about the relationship between the current and the distance between the torch and the photocell.

---

[2]

(iii) Explain why this trend happens.

---

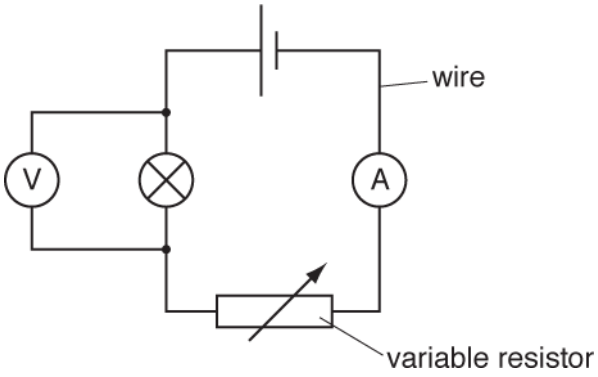
[1]

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24 Riya connects an electrical circuit.



The voltmeter reading is 3.0 V.

The ammeter reading is 1.5A.

(i) Calculate the resistance of the lamp.

---

answer ---------- ohms **[2]**

25 Kate designs a moving robot that detects changes in **light** and **warmth**.

Which **two** components must she use?

Choose from

diode

lamp

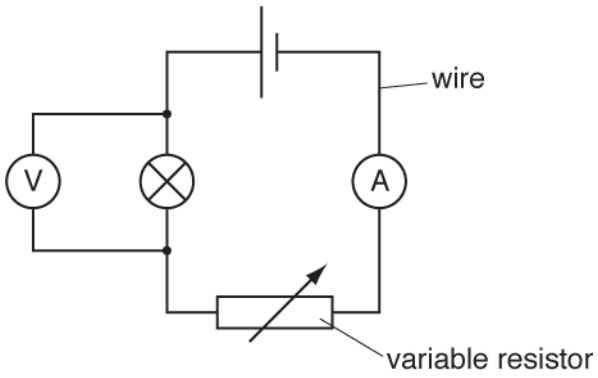
LED

LDR

thermistor

---------- and ----------[2]

26 Riya connects an electrical circuit.



The voltmeter reading is 3.0 V.

The ammeter reading is 1.5A.

(i) Calculate the resistance of the lamp.

---

answer _____ ohms **[2]**

(ii) Riya wants to decrease the total resistance of the circuit.

She **cannot** change the voltage.

Describe **two** changes she could make to this electrical circuit to decrease the total resistance.

---

[2]

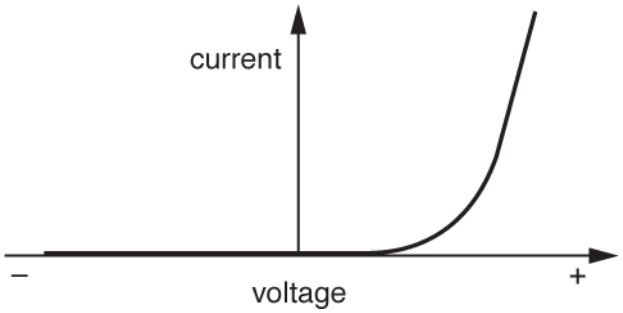
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27(a) Tanya uses different components in a circuit.

(i) She measures the current and voltage across one of the components.

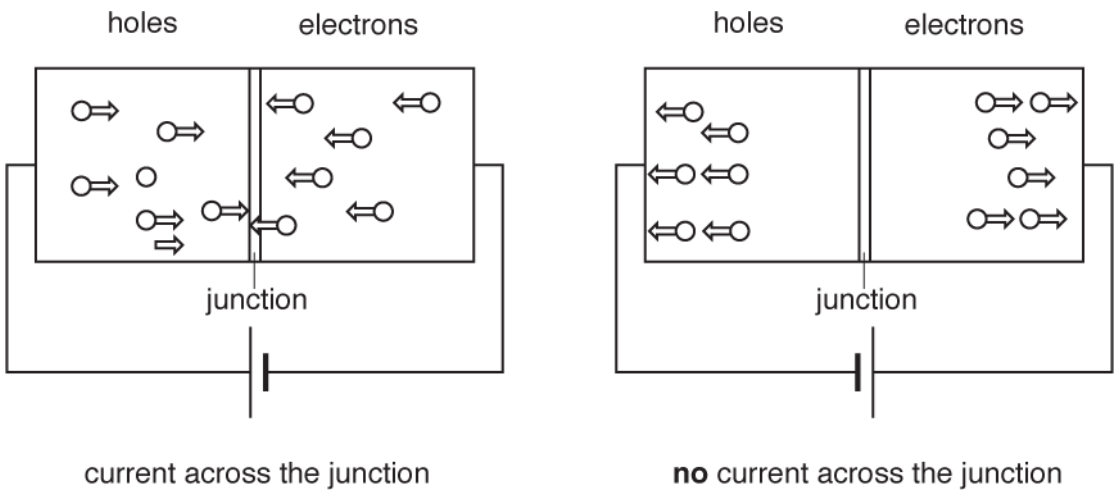


Tanya looks at the graph and decides this component is a silicon diode.

Explain why Tanya is correct.

--- [2]

(ii) Tanya draws two diagrams to show how a silicon diode works.



The holes are positive (+) and the electrons are negative (–).

Use the diagrams to explain how a diode works.

--- [3]

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(b) Another component in the circuit is a thermistor.

Tanya measures the resistance of this thermistor at different temperatures.

Temperature in °C	Resistance in ohms
15	15.8
20	12.4
25	10.0
30	8.0
35	6.5
40	5.3

Describe, in detail, how the resistance of **this** thermistor varies with temperature.

---

[2]

28 Which voltage is the maximum voltage made when **four** 1.5 V cells are connected in **series**?

A 0 V

B 1.5 V

C 3.0 V

D 6.0 V

Your answer ☐ **[1]**

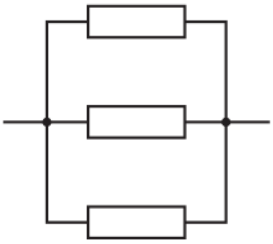
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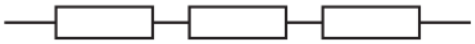
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29 A student has 3 identical resistors. She arranges them in four different ways.

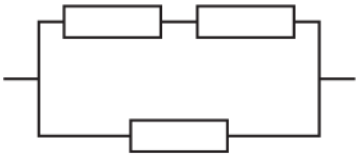
A



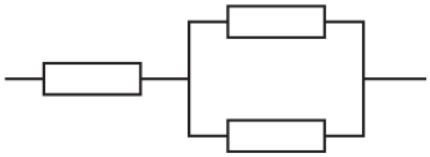
B



C



D



Which arrangement has the **most** resistance?

Your answer [1]

30(a) A student uses four electrical appliances for different lengths of time.

Look at the table.

Appliance	Power (W)	Time used (hours)
Hair dryer	1500	0.3
TV	100	5
Toaster	2000	0.2
Light bulb	10	12

(i) Which appliance uses the **most** energy?

[1]

(ii) Which appliance uses the **least** energy?

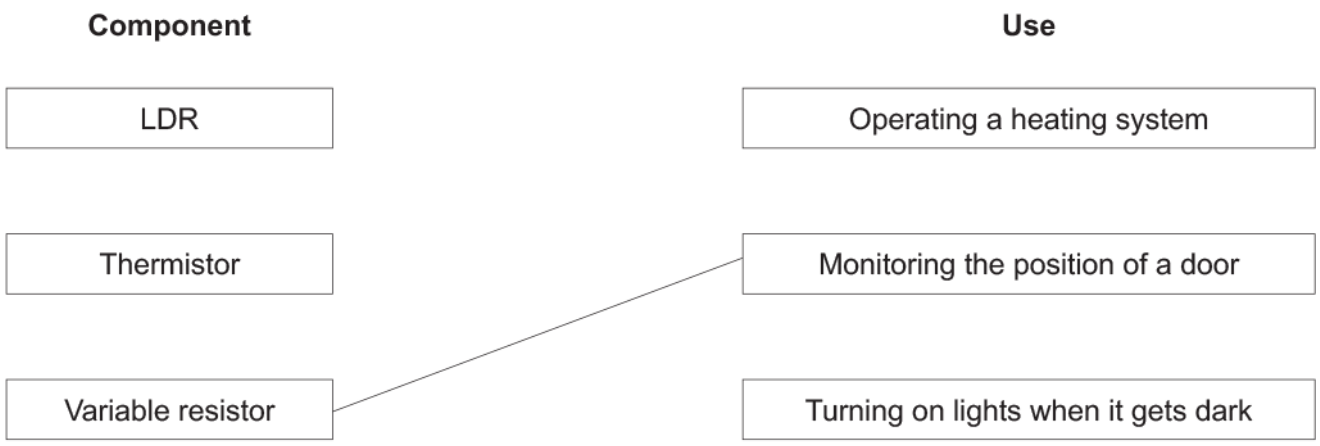
[1]

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(b) Here are three different components and their use in the home.

Match the component to its correct use.

One has been done for you.



[2]

(c) A charge of 44 000 C flows through a light bulb. The potential difference is 230 V.

Calculate the energy transferred.

Use the equation: Charge = Energy ÷ Potential difference

Record your answer to **2** significant figures.

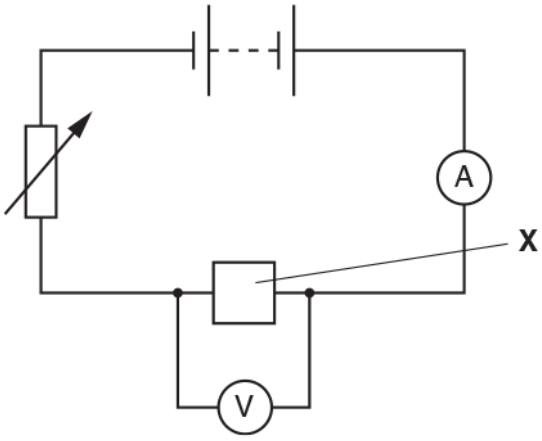
Answer = ... J **[4]**

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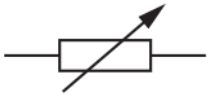
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31(a) A student builds a circuit to investigate the resistance of component **X**.



(i) What is the name of this component?



---------- [1]

(ii) Why is this component needed in this circuit?

---------- [1]

(b) Component **X** has a resistance of 16 Ω when a current of 0.25 A flows.

(i) Calculate the potential difference across component **X**.

Use the equation: Potential difference = Current × Resistance

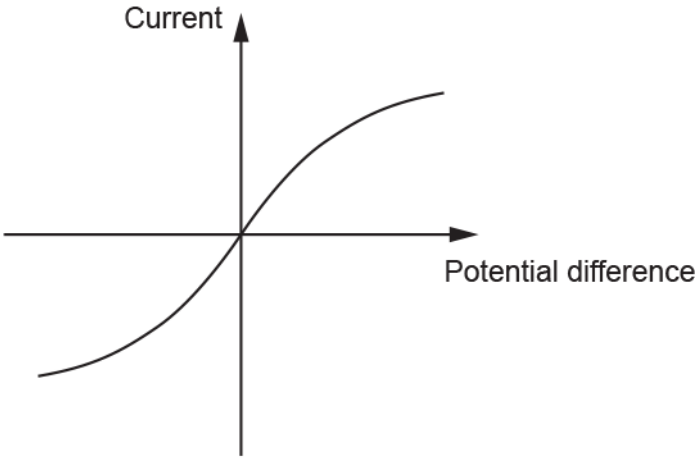
Answer = ... V **[2]**

(ii) Calculate the power of component **X** when a current of 0.25 A flows.

Answer = ... W **[3]**

(c) The student uses the circuit to take current and potential difference readings.

The student plots a graph of her results.



(i) Look at the graph.

What is component **X** in the circuit?

---

[1]

(ii) The resistance of component **X** varies as the potential difference changes.

Describe **how** the graph shows this and explain **why** this happens.

---

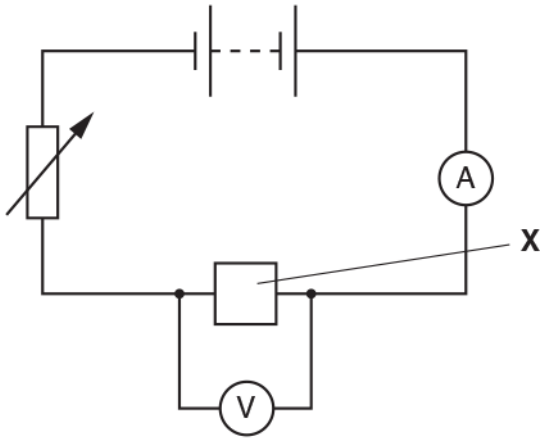
[3]

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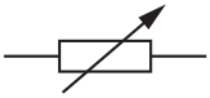
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32(a) A student builds a circuit to investigate the resistance of component **X**.



(i) What is the name of this component?



---------- [1]

(ii) Why is this component needed in this circuit?

---------- [1]

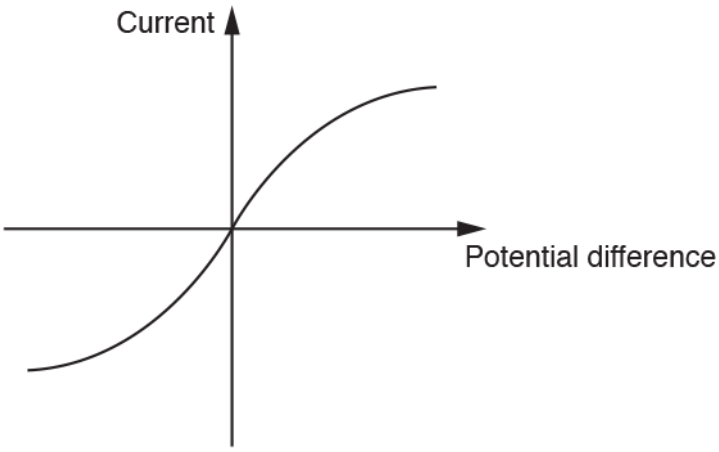
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(b) The student uses the circuit to take current and potential difference readings.

The student plots a graph of her results.



(i) Look at the graph. What is component **X** in the circuit?

---

[1]

(ii) The resistance of component **X** varies as the potential difference changes.

Describe how the graph shows this and explain why this happens.

---

[3]

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(c) Component **X** has a resistance of 16 Ω when a current of 0.25 A flows.

(i) Calculate the potential difference across component **X**.

Use the equation: Potential difference = Current × Resistance

Answer = ... V **[2]**

(ii) Calculate the power of component **X** when a current of 0.25 A flows.

Answer = ... W **[3]**

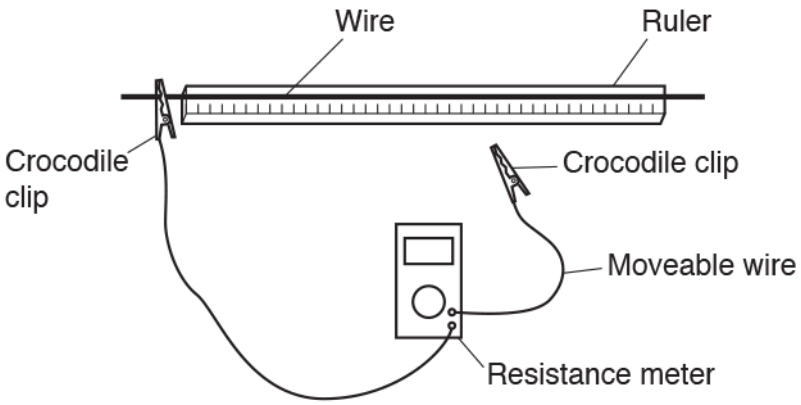
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33(a) Two students investigate the resistance of a wire.

They tape a length of wire to a metre ruler and connect it to a resistance meter using crocodile clips.



Look at their results.

Length of wire (cm)	Resistance (Ω)			
	Attempt 1	Attempt 2	Attempt 3	Mean
25	8.8	8.3	8.5	8.533
50	16.2	16.1	16.4	16.4
75	23.5	23.8	18.7	23.7
100	30.8	31.1	31.0	31.0

(i) Describe the pattern shown by these results.

Use data in your answer.

--- [2]

(ii) The students made **two** mistakes when they recorded their results and completed the table.

Identify the mistakes **and** explain what they should have done.

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[2]

(iii) The students have correctly handled an anomaly in their results.

Identify the anomaly and explain how it was correctly handled.

[2]

(iv) The students plan to plot a graph of mean resistance against length.

What would you expect a graph of these results to look like?

[2]

(b)

(i) The actual mean resistance values are more than expected.

Suggest **two** possible errors with the experiment.

[2]

(ii) For **one** of the errors, suggest how the experimental procedure could be improved.

[1]

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34 A domestic wind turbine has a power rating which varies from 1.0 kW to 3.0 kW.

(i) The domestic wind turbine has an electrical resistance of 23 Ω.

It generates a current of 11 A on a windy day.

Calculate the power output in kW of the turbine on this day.

Answer = ---------- kW **[4]**

() Suggest why the manufacturer gives a range for the power rating of the wind turbine.

---**[1]**

(i) Using just **one** domestic wind turbine may be an unreliable source of power for a house.

State a reason why.

---**[1]**

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35 A domestic wind turbine has a power rating which varies from 1.0 kW to 3.0 kW.

(i) The domestic wind turbine has an electrical resistance of 23 Ω.

It generates a current of 11 A on a windy day.

Calculate the **power** output in kW of the turbine on this day.

Answer = ---------- kW **[4]**

(ii) Suggest why the manufacturer gives a range for the power rating of the wind turbine.

---

[1]

(iii) Using just **one** domestic wind turbine may be an unreliable source of power for a house.

State a reason why.

---

[1]

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36 A TV works with a 12.0 V battery. It has a current of 3.19 A.

Calculate the power rating of the TV.

Power = ... W **[3]**

37(a) Energy is transferred at high voltages in the national grid.

This house is near to a transmission line.



Explain why radio waves may be produced by the transmission line.

---

[2]

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(b) Explain why it is more efficient to transfer energy at high voltages.

---

[2]

(c) The transmission line has a power loss of 6.156 kW.

Its resistance is 15.39 Ω.

Calculate the current in the transmission line.

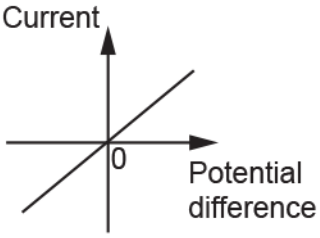
Current = ... A **[5]**

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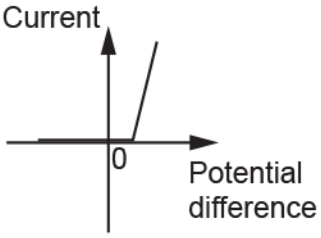
38 A student investigates four different electrical components.

She plots current-potential difference graphs for the components.

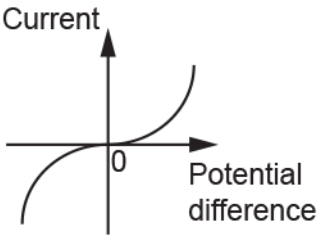
A



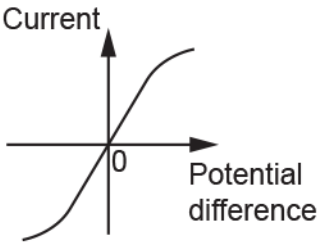
B



C



D



Which of the above shows the characteristic graph for a diode?

Your answer ☐ **[1]**

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39(a) A TV has the label below on it.

OCR TV
Voltage: 230 V Power: 65 W Frequency: 50 Hz

Calculate the **current** in the TV when it is turned on.

Use the equation: power = potential difference × current

Give your answer to **2** significant figures.

Current = ... A **[4]**

(b) The TV is turned on for 30 minutes.

Calculate the energy transferred by the TV.

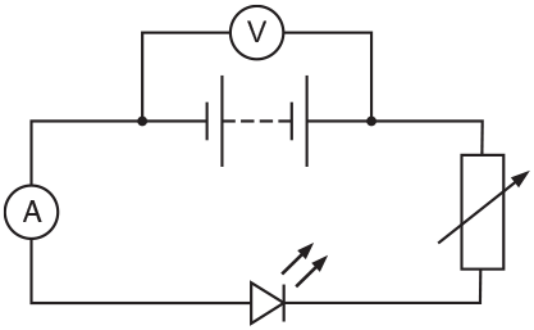
Energy used = ... J **[4]**

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40(a) A student investigates the electrical characteristics of a light emitting diode (LED).

The student builds a circuit to investigate how the current through an LED and the potential difference across it vary when the LED lights up.

Look at the circuit diagram.



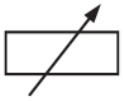
(i) The student has made **two** errors connecting the circuit.

Identify the errors.

1 _____

2 _____

[2]

(ii) What is the purpose of the component  in the circuit?

_____

[1]

(b) The student then connects the circuit correctly. He measures the current through the LED as 0.03 A when the potential difference across it is 3.0 V.

(i) Calculate the resistance of the LED.

Use the equation: potential difference = current × resistance

Resistance = ... Ω **[3]**

(ii) Calculate the charge which flows when this LED operates for 2.5 minutes.

Charge = ... C **[4]**

(iii) Calculate the energy transferred when this LED operates for 2.5 minutes.

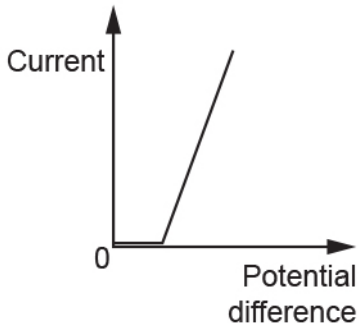
Use the equation: energy transferred = charge × potential difference

Energy transferred = ... J **[2]**

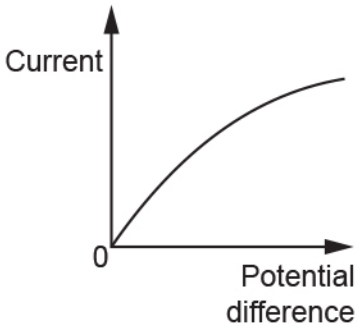
41 A student investigates how current and potential difference vary in different components.

Look at the graphs of her results.

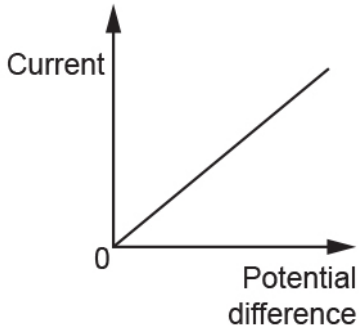
A



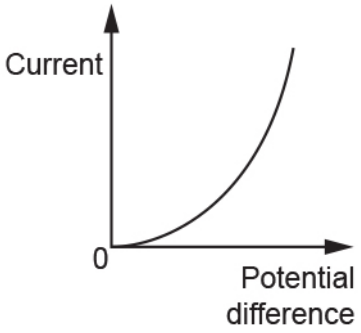
B



C



D



Which graph shows a filament lamp?

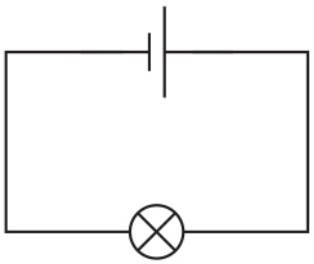
Your answer ☐ **[1]**

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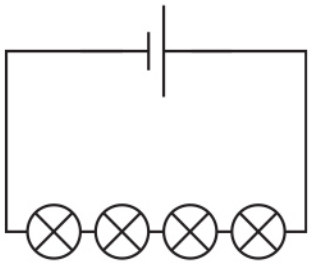
42 A student sets up four different circuits. He uses identical lamps and the same cell.

Look at the diagrams of his circuits.

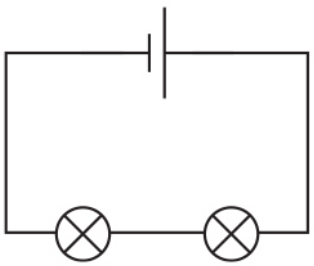
A



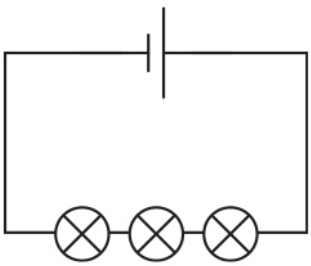
B



C



D



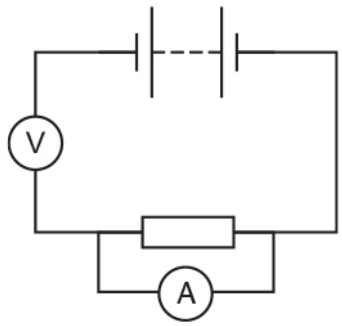
Which circuit has the brightest lamp(s)?

Your answer [1]

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43(a) A student sets up a circuit to find out the resistance of an unknown resistor. The student makes **three** mistakes in their circuit.

Look at the circuit diagram of their experiment.



(i) Write down the **three** mistakes the student makes.

1 _____

_____

2 _____

_____

3 _____

_____ **[3]**

(i) For **one** of the mistakes identified in **(i)** describe how the student can fix the error.

_____

_____ **[1]**

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(b) The student finds that the current is 20 mA when the potential difference is 4.0 V.

Calculate the **resistance** of the unknown resistor.

Include the **unit** for resistance in your answer.

Use the equation: resistance = potential difference ÷ current.

Resistance = ... Unit = ... **[4]**

44(a) A TV has the label below on it.

OCR TV
Voltage: 230 V Power: 65 W Frequency: 50 Hz

Calculate the **current** in the TV when it is turned on.

Use the equation: power = potential difference × current

Give your answer to **2** significant figures.

Current = ... A **[4]**

(b) The TV is turned on for 30 minutes.

Calculate the energy transferred by the TV.

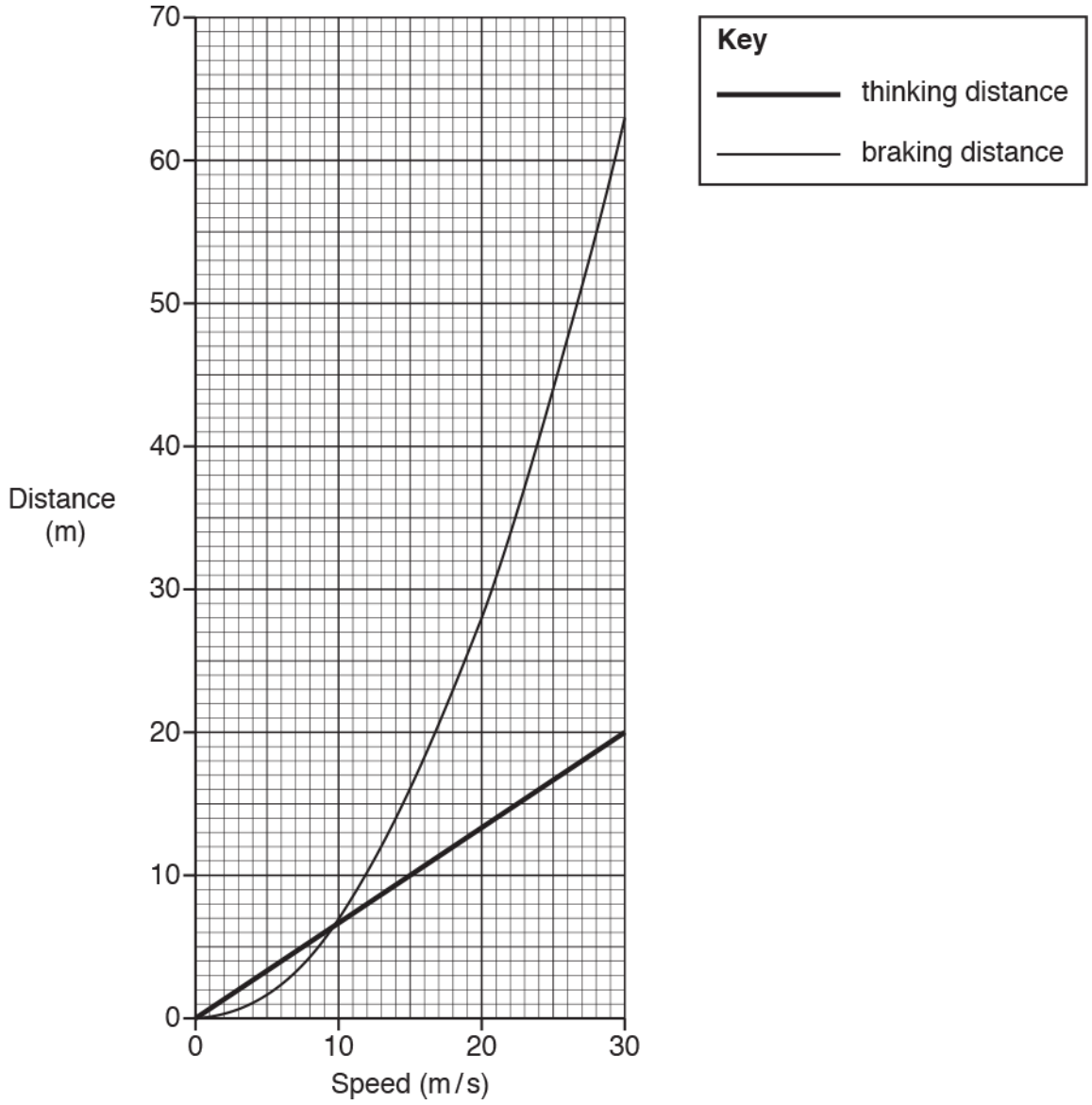
Energy used = ... J **[4]**

45 The graph shows thinking and braking distances for a car at different speeds.

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Describe how **thinking distance** varies with increasing speed.

Use data from the graph in your answer.

[2]

46 The table shows the current and potential difference for four different lamps.

Which lamp has the highest **power**?

Use the equation: power = potential difference × current

	Current (A)	Potential difference (V)
A	2	5
B	3	4
C	4	2
D	5	1

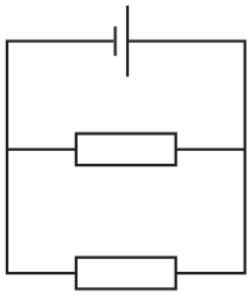
Your answer ☐ **[1]**

47 Calculate the charge when 200 J of energy is transferred with a potential difference of 40 V.

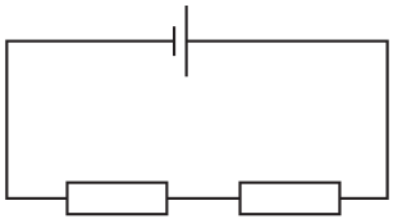
Use the equation: energy transferred = charge × potential difference

Charge = ... C **[3]**

48(a) A student builds two electrical circuits. Each circuit uses identical cells and identical fixed resistors.



A



B

Explain why circuit **A** has a lower total resistance than circuit **B**.

---

[2]

(b) A student investigates the resistance of a filament lamp.

(i) Explain why the resistance of a filament lamp increases when current increases.

---

[2]

(ii) Design a circuit diagram which could be used to investigate how the resistance of a filament lamp changes with current.

Use the circuit symbols below. Each symbol can be used once, more than once, or not at all.



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[2]

(iii) Describe how the student would use the circuit you have drawn in **(ii)** to investigate how the resistance of a filament lamp changes with current.

---

[3]

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49 Water can be heated using a 12 V heater.

A transformer is used to change a 120 V supply into 12 V.
The current in the secondary coil is 9.0 A.

Calculate the current in the primary coil.

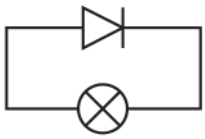
Use an equation from the data sheet.

Current = ... A **[2]**

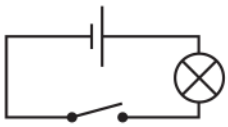
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50 A student sets up four electrical circuits.

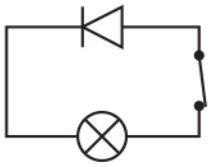
A



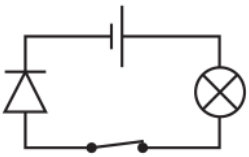
B



C



D



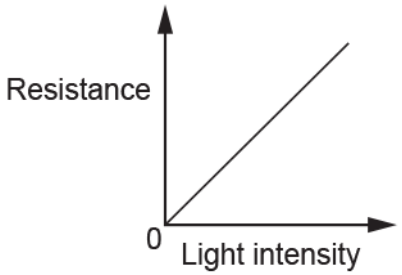
Identify in which circuit the lamp will light up.

Your answer ☐ [1]

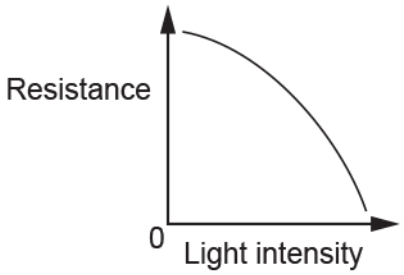
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51 A student investigates how the resistance of a light dependent resistor (LDR) changes with light intensity.

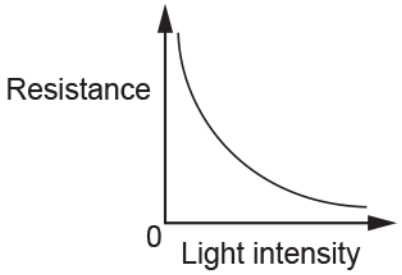
A



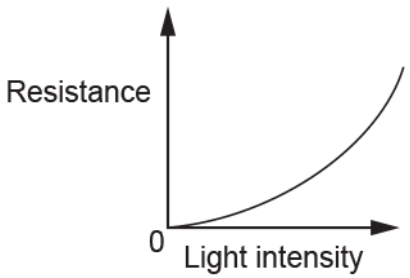
B



C



D



Which graph shows the correct relationship between the resistance of an LDR and light intensity?

Your answer ☐ [1]

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52 Which item uses the most power?

Use the equation: power = potential difference × current

	Item	Current (A)	Potential difference (V)
A	Calculator	0.1	3
B	Mobile Phone	1.0	5
C	Radio	0.5	12
D	Torch	1.2	6

Your answer ☐ [1]

53(a) A student sets up the circuit in **Fig. 17.1** to investigate the resistance of a lamp.

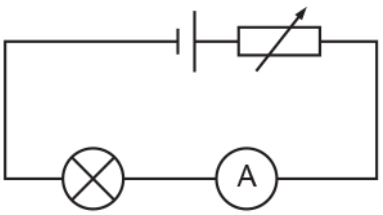


Fig. 17.1

(i) The student also needs to add a voltmeter to the circuit.

On **Fig. 17.1 draw** where the voltmeter should be connected. **[2]**

(ii) The student takes readings of potential difference and current and records them in **Table 17.1**.

Potential difference (V)	Current
1.0	1.000
2.0	1.9
3.0	2.7
4.0	3.2
5.0	3.5

Table 17.1

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There are **two** mistakes in the results table.

Write down the **two** mistakes and suggest how they could be corrected.

Mistake 1: _____

Correction 1: _____

Mistake 2: _____

Correction 2: _____

[4]

(iii) Calculate the resistance of the lamp when the potential difference is 4.0 V in **Table 17.1**.

Use the equation: potential difference = current × resistance

Resistance = ... Ω **[3]**

(b) The student plots the results from **Table 17.1** on the graph in **Fig. 17.2**.

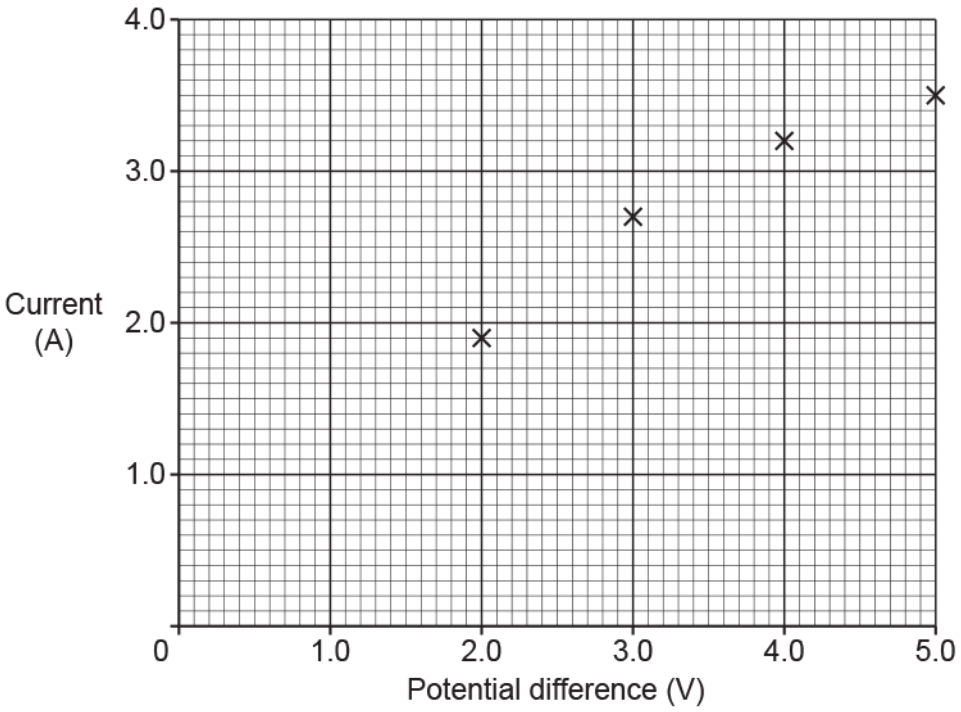


Fig. 17.2

(i) Plot the missing point at 1.0 V on the graph **and** draw a line of best fit.

[2]

(ii) Describe the relationship between potential difference and current.

Use data from the graph to support your answer.

---

[2]

(iii) Explain how you could use the circuit in **Fig. 17.1** to investigate the resistance of a fixed resistor instead of a

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lamp.

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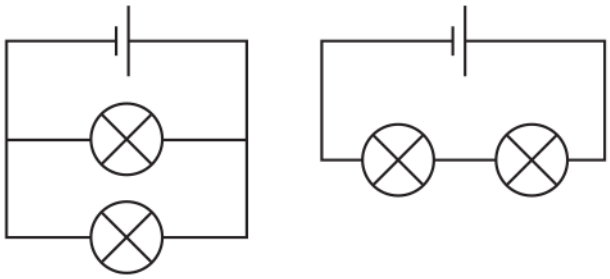
[2]

(iv) Explain how and why the graph in **Fig. 17.2** would look different for a fixed resistor at a constant temperature.

---

[2]

54 A student investigates if lamps are brighter in a series circuit or a parallel circuit. He sets up two different circuits, **A** and **B**.



A **B**

State which circuit will have the brightest lamps and explain why.

In your answer, include the variables that the student will need to control in this experiment.

---

[6]

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55 Calculate the charge when 200 J of energy is transferred with a potential difference of 40 V.

Use the equation: energy transferred = charge × potential difference

Charge = ... C **[3]**

END OF QUESTION PAPER