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EB Education Revision Guide

How to work with Required Practicals: Part 3
Combined (AQA Physics Paper 1 2022)

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Assessed Required Practical Activities
Paper 1
Foundation & Higher

Required practical activity 14: An investigation to determine the specific heat capacity of one or more materials. The investigation will involve linking the decrease of one energy store (or work done) to the increase in temperature and subsequent increase in thermal energy stored.
Required practical activity 16: Use circuit diagrams to construct appropriate circuits to investigate the I–V characteristics of a variety of circuit elements, including a filament lamp, a diode and a resistor at constant temperature.

Practical 14: Specific Heat Capacity

What you need to know

Be able to find out the specific heat capacity of a material.

You will measure the temperature and mass of different metal blocks, heat them up, and measure the increase in temperature. You could find out the specific heat capacity of other materials, for example, water, by heating a certain mass, and measuring the temperature increase over a certain time.

You may need to explain:

a) Why you insulate the block in order to prevent heat loss to the environment. This will ensure that as much heat as possible is transferred into the block.

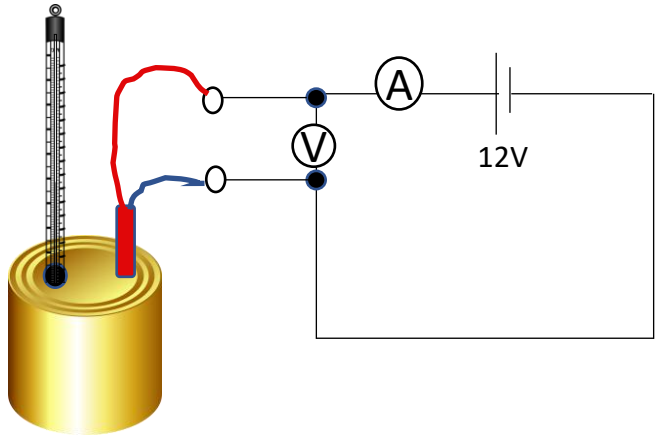
b) Why the temperature increase will be slower at the beginning of the experiment, as the block begins to heat up.

You should repeat the measurements, and then calculate the mean.

If you plot a graph of energy transferred (x axis) against temperature change (y axis) the gradient will be specific heat capacity x mass

Divide the gradient by the mass of the block to find a value for the specific heat capacity

Diagram



Specific heat capacity c(J/kg°C) = $\frac{\text{energy transferred } \Delta E \text{ (J)}}{\text{mass m(kg) x temperature change } \Delta \theta \text{ (°C)}}$

A joulemeter is used to measure the energy.
If there is no joulemeter, an ammeter, voltmeter and stop clock or a power meter can be used to calculate the amount of energy.
Power = current x potential difference
Energy = power x time

Practical 16:I-V Characteristics

What you need to know

To be able to use circuit diagrams and to construct test circuits to investigate the I-V characteristics of elements including a filament lamp, a diode and a resistor at constant temperature. You would measure the voltage and current and plot a graph.

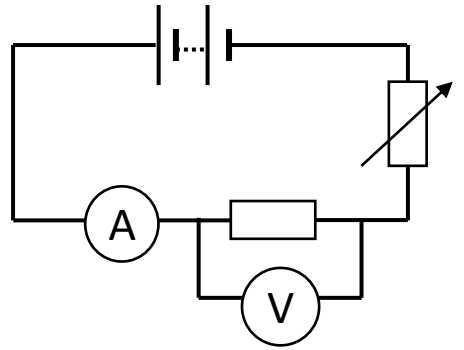
You will need to be able to:
Explain the pattern for each component:
a) Resistor (fixed value)
The current flowing through a resistor at a constant temperature is directly proportional to the potential difference across it. This is called **Ohm's law**.

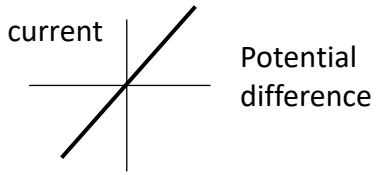
b) Lamp
The resistance increases as the temperature of the filament increases. Increased potential difference will mean current is increased, but at a high potential difference, as the filament gets hot, ions vibrate more so resistance increases and current levels off.

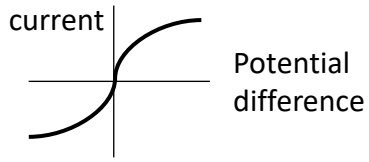
c) Diode
The current can only flow in one direction, as it has a very high resistance in the other direction. There is also a threshold voltage needed before and current can flow, after this voltage the resistance drops dramatically and a large current flows.

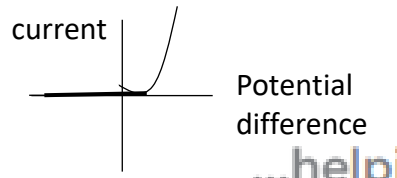
Diagram

A Test Circuit







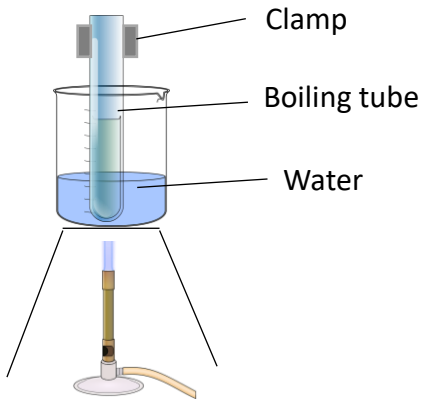


Top Tips:
Voltmeter must be connected in parallel across the device you are testing.
Ammeter must be connected in series to the device you are testing.
The variable resistor is used to control the voltage dropped across the device that is being tested.

Your turn:

1. Lara investigated the change in temperature when oils of different specific heat capacities were heated.

She set up the apparatus below.



She placed 30 g of oil into a boiling tube, and 100 ml of water into a beaker. She heated the water until it was boiling, and then placed the boiling tube into the water.
Once the temperature of the oil reached 30°C she heated the oil for a further 30 seconds and then recorded the rise in temperature.
Lara repeated this with different oils, and then repeated the whole investigation.

a) Name two pieces of apparatus Lara used that are not shown in the diagram.
1……
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2……
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b) What are the independent and dependent variables in Lara's investigation?
Independent variable
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……
Dependent variable
……
……

c) Name two safety precautions Lara should have taken.
1……
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2……
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Your turn:

d) Suggest an improvement to her method.

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e) Lara's results are shown below.

	Temperature rise in °C			
Type of oil	1	2	3	Mean
Castor oil	19	20	21	20
Mineral oil	21	21	21	21
Olive oil	17	17	18	
Linseed oil	18	19	19	19
Sesame oil	20	23	23	22

Calculate the mean temperature rise for olive oil. Give your answer to two significant figures.

……

f) The specific heat capacity of 1800 J/kg °C.
The mass of oil used is 0.025kg.
The mean change in temperature of the castor oil is 20°C.

Using the correct equation, calculate the change in thermal energy of the castor oil that Lara used.
Include a unit in your answer.

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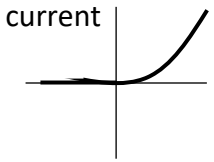
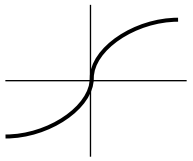
Your turn

2. The graphs below show how the current through a component changes with the potential difference across the component.
Match each graph with the correct component.

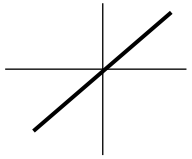
A filament lamp



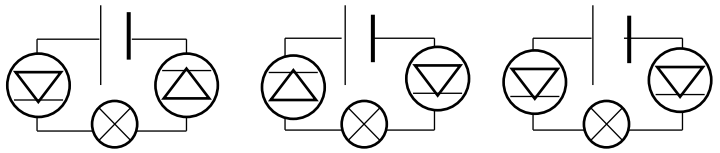
A resistor at constant temperature



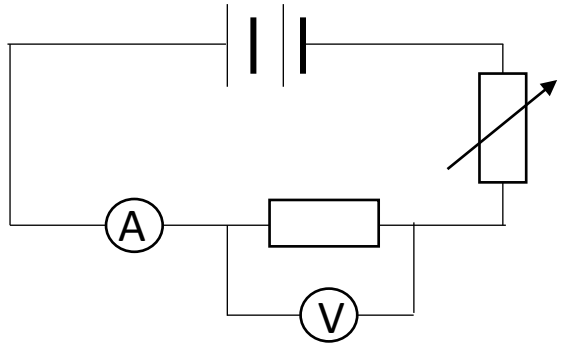
A diode



b) The circuits below all include two diodes.
In which circuit will the filament lamp be on?



c)



Describe how this circuit could be used to determine the resistance of the resistor?

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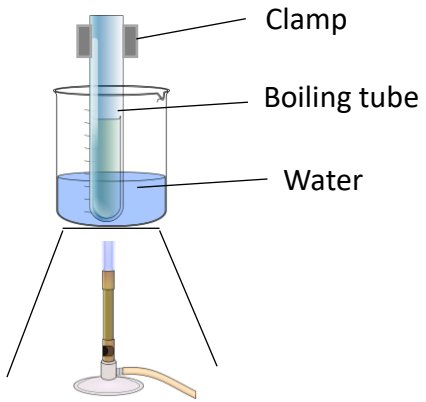
Answers:

1. Lara investigated the change in temperature when oils of different specific heat capacities were heated.

She set up the apparatus below.



She placed 30 g of oil into a boiling tube, and 100 ml of water into a beaker. She heated the water until it was boiling, and then placed the boiling tube into the water.
Once the temperature of the oil reached 30°C she heated the oil for a further 30 seconds and then recorded the rise in temperature.
Lara repeated this with different oils, and then repeated the whole investigation.

a) Name two pieces of apparatus Lara used that are not shown in the diagram.

1 Measuring cylinder

2 Top pan balance

b) What are the independent and dependent variables in Lara's investigation?

Independent variable

Type of oil

Dependent variable

Temperature change

c) Name two safety precautions Lara should have taken.

1 Safety goggles

2 Oil not heated directly

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Answers:

d) Suggest an improvement to her method.

Heat for a longer period of time to get a wider range of temperatures

e) Lara's results are shown below.

	Temperature rise in °C			
Type of oil	1	2	3	Mean
Castor oil	19	20	21	20
Mineral oil	21	21	21	21
Olive oil	17	17	18	
Linseed oil	18	19	19	19
Sesame oil	20	23	23	22

Calculate the mean temperature rise for olive oil. Give your answer to two significant figures.

17 + 17 + 18/ 3 = 17.33

temperature rise = 17 °C (to 2 sig. fig.)

f) The specific heat capacity of 1800 J/kg °C.
The mass of oil used is 0.025kg.
The mean change in temperature of the castor oil is 20°C.

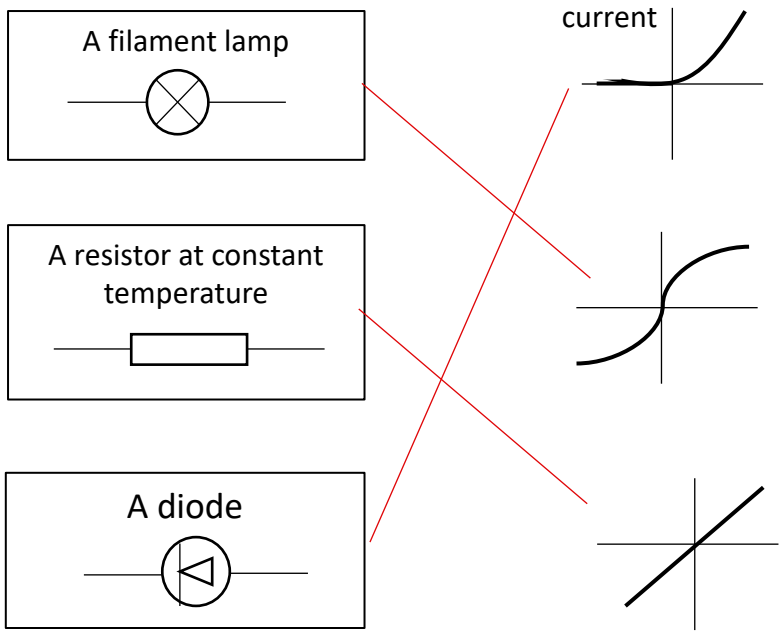
Using the correct equation, calculate the change in thermal energy of the castor oil that Lara used.
Include a unit in your answer.

E = 0.025 × 1800 × 20

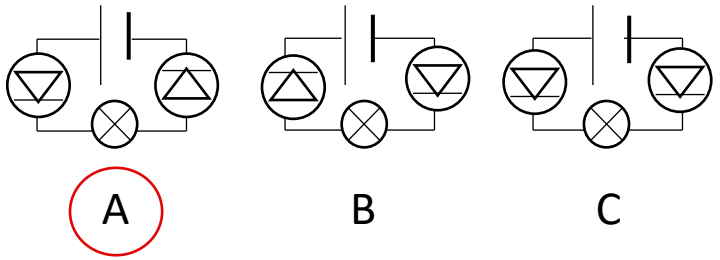
E = 900 J

Answers

2. The graphs below show how the current through a component changes with the potential difference across the component.
Match each graph with the correct component.



b) The circuits below all include two diodes.
In which circuit will the filament lamp be on?

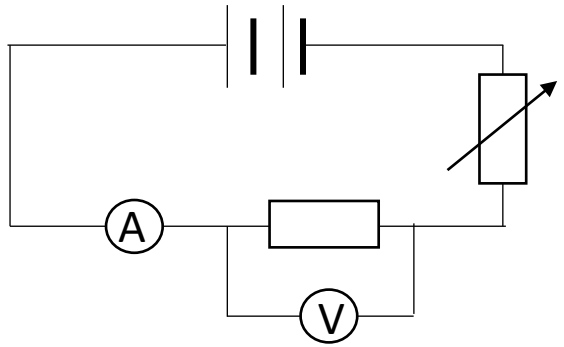


This is because the diode are connected in the correct direction to allow current to flow

Answers

c) Describe how this circuit could be used to determine the resistance of the resistor?

Set up and switch on the circuit. Remember to switch off in between readings so the resistor doesn't overheat
Take an ammeter reading, take a voltmeter reading
Repeat and calculate the mean.
Adjust the variable resistor to change the current
Take new readings from the ammeter and voltmeter
Repeat at different resistances on the variable resistor.
Draw a voltage-current graph
Measure the gradient of the graph
Use the equation:
Resistance = voltage ÷ current



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For more help and resources, or to work with us as a tutor, please contact us

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