Specific heat capacity - required practical - worksheet

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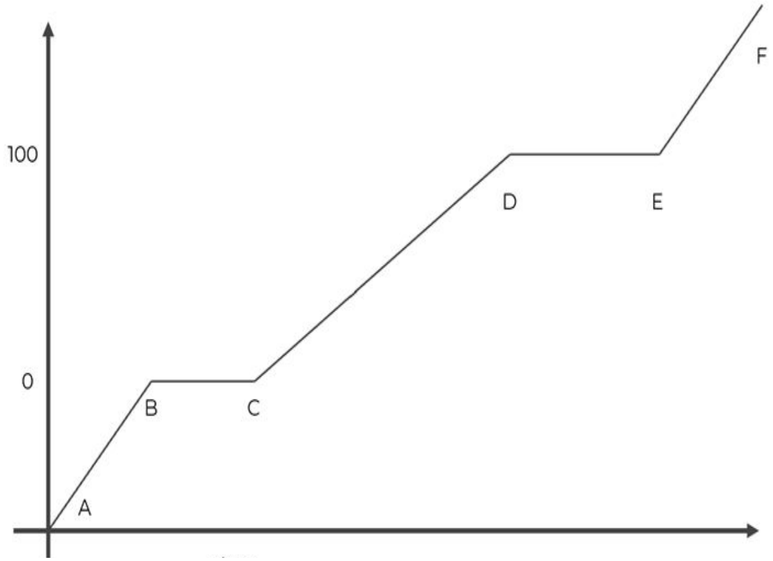
In lesson questions


100
0
A
B
C
D
E
F

Step	Reason
Measure and record the mass of the block in kg.	
Place the heater in the larger hole in the block. Use the pipette to put a small amount of water in the other hole. Put the thermometer in this hole.	
Connect the ammeter, power pack and heater in series. Connect the voltmeter across the heater in parallel	
Set the power pack to 12 V. Switch on the power pack to turn on the heater. Record the ammeter and voltmeter readings.	
Record temperature on the thermometer and start the stopwatch	
Record temperature every 60 s for 10 minutes	

Design a method

Write a method to investigate the specific heat capacity of water.

1. *Pour ……. Of water into a ……*
2. *Record the ……*
3. *Place a thermometer and heater ……*
4. *Record ……*
5. *Turn on heater and ……*
6. ……
7. ……
8. …..
9. …..

- Independent variable
- Dependent variable
- Reducing uncertainty - which is the biggest losses
- What will go on the graph?
- How do you need to use the graph?

Data analysis

Material	Energy transferred in Joules	Mass of block in kg	Temperature change in °C	Specific heat capacity in J/kg °C
Copper	3 400	1.10	8	
Aluminium	14 490	1.05	15	
Iron	4 218	0.95	10	

Energy change = mass × specific heat capacity × change in temperature

Conclusions

Material	Specific heat capacity in J/kg °C
Copper	**390**
Aluminium	**920**
Iron	**444**

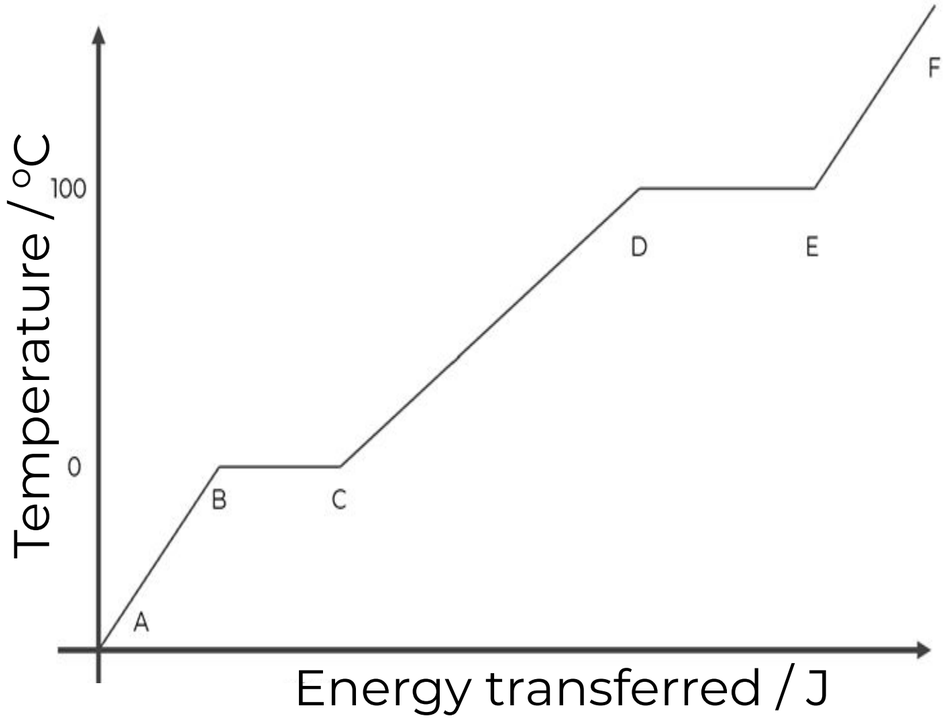
Type of metal block	Density in g/cm^3
Copper	8.96
Aluminium	2.70
Iron	7.87

1. Hypothesis: Denser materials have a higher specific heat capacity.
   a. Use the data to say whether this is true.
      - The data shows that…….
   b. Explain your reasoning.
      - The specific heat capacity for aluminium is…. And the density is…. This compares to …….

Answers

Review

1. Sections A-B, C-D and E-F are related to heat capacity.
2. This graph will only identify the heat capacity of the material, because it does not indicate the mass. The total energy transferred will depend upon the mass.



Step	Reason
Measure and record the mass of the block in kg.	**To be used to calculate specific heat capacity**
Place the heater in the larger hole in the block. Use the pipette to put a small amount of water in the other hole. Put the thermometer in this hole.	**To allow for temperature to be measured**
Connect the ammeter, power pack and heater in series. Connect the voltmeter across the heater in parallel	**To allow for power to be measured**
Set the power pack to 12 V. Switch on the power pack to turn on the heater. Record the ammeter and voltmeter readings.	**To transfer energy to the block**
Record temperature on the thermometer and start the stopwatch	**Measure temperature and allow for energy transferred to be calculated**
Record temperature every 60 s for 10 minutes	

Design a method

Write a method to investigate the specific heat capacity of water.

1. *Pour **250 cm^3** Of water into a **beaker and wrap it in insulation***
2. *Record the **mass of the water***
3. *Place a thermometer and heater into the beaker*
4. *Record **temperature** **of the water using the thermometer***
5. *Turn on heater and **record the power of the heater using P = I V.***
6. ***Record the temperature every 60 s for 10 minutes.***
7. ***Plot a graph of energy transferred against temperature***
8. ***Use the straight line section to find the gradient.***
9. ***Specific heat capacity = 1/(gradient x mass). Use this to calculate specific heat capacity***

Data analysis

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Energy change = mass × specific heat capacity × change in temperature

Review

1. Hypothesis: Denser materials have a higher specific heat capacity.
   a. Use the data to say whether this is true.
      - The data shows that **the more dense materials do not always have a higher specific heat capacity**
   b. Explain your reasoning.
      - The specific heat capacity for aluminium is **920 J/kg °C** And the density is **2.70 g/cm^3** . This compares to **Copper (or Iron) which has 390 J/kg °C (444 J/kg °C) and density of 8.96 g/cm^3 (7.87 g/cm^3).**