

## Workbook Questions

### 9 Energy changes

#### 9.1 Energy changes in chemical reactions

- 1 Exothermic changes release heat to the surroundings.  
Exothermic changes include combustion reactions.  
Endothermic changes include evaporation.  
Endothermic reactions take in heat from the surroundings.  
Endothermic changes include melting.

2 melt, cold, takes in, start, endothermic

3a B: +48

D: -13

E: +61

b A, B, E

c E

d C, D

e C, D

f A, B, E

#### Extension:

Energy is taken in from the surroundings, giving the particles enough energy to overcome the forces holding the particles together as a liquid.

#### 9.2 Investigating fuels

1a top to bottom: control, change, control, measure

b To find out if his experiment will work.

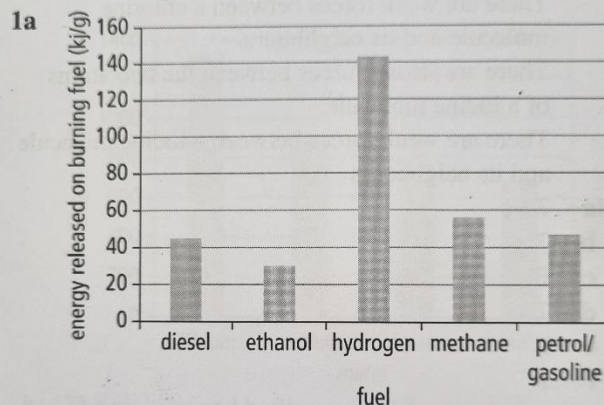
c i to reduce error, to make the results more reliable

ii butanol (81)

iii 40

iv Butanol releases the most energy when it burns, methanol releases the least.

### 9.3 Choosing fuels



b ethanol, diesel, petrol/gasoline, methane, hydrogen

c Diesel, ethanol and petrol are liquids at room temperature.

### 9.4 Calculating food energy

1a Top to bottom: wear gloves and be careful when moving around.

Ensure that anyone with allergies is not in the room.

b 100 cm<sup>3</sup>, this volume provides a reasonable temperature change without boiling the water.

c i To reduce errors and make the results more reliable.

ii

Nut	Temperature change 1 (°C)	Temperature change 2 (°C)	Temperature change 3 (°C)	Average temperature change (°C)
1				
2				
3				

d i cashew nut, peanut, walnut

ii There is a difference of 6 °C between the highest and lowest values. There could have been some anomalies. Cerena didn't state the mass of the nuts she would use.

### 9.5 Investigating endothermic changes

1 takes in, from, freezes, cools down

2a i top to bottom: control, change, control, measure, control

ii Keeping these variables the same makes the results comparable/fair test.

b top to bottom: -13, -6, +23, +7

c Habibah is correct. Solutes A and B are the two endothermic reactions and solute A is the most endothermic.

## Textbook questions

### 9 Energy changes

#### 9.1 Energy changes in chemical reactions

- 1 Burning a fuel, neutralisation reactions
- 2 Melting and evaporating
- 3 Dissolving
- 4 When a reaction releases energy, the energy heats up the mixture before being transferred to the surroundings, increasing the temperature.

#### 9.6 Review

1 given out, increases, taken in, decreases

2

Type of change	Is the change exothermic?	Is the change endothermic?
combustion (burning)	✓	
neutralisation	✓	
evaporation		✓
melting		✓
freezing	✓	

3a copper sulfate

b potassium nitrate

4a The reaction is endothermic, taking in energy (heat) from the surrounding area, reducing the temperature of the water, causing it to freeze.

b Endothermically, the surrounding area gets cooler (the water freezes) demonstrating that heat has been taken in (an endothermic reaction).

5a  $56 - 23 = 33^{\circ}\text{C}$

b An increase in temperature shows that heat has been given out. Exothermic reactions give out heat.

6a fuel

b temperature change

c the amount of fuel, the temperature of the water at the start, the distance between the spirit burner and the calorimeter

d The temperature change in large/small volumes would be harder to measure and less accurate.

e i propanol/temperature at start:  $20^{\circ}\text{C}$   
butanol/temperature change:  $45^{\circ}\text{C}$

ii ethanol

f To improve the reliability of her results.

g the surroundings