

Q3 a. Why is this wrong? What do we call the reaction when the temperature decreases?

(a) When a solid amount of ammonium chloride is shaken with water, a colourless solution forms and the temperature changes from 20°C to 16°C.

Give the name of the type of heat change occurring.

decrease

(1)

Q3 b i. This is correct, which other pieces of equipment could you use instead?

(b) A student carries out an experiment to measure accurately the temperature changes when different metals are added to iron(II) sulfate solution.

The method for the experiment is:

- measure 25 cm³ of iron(II) sulfate solution and pour into a container
- record the initial temperature of the solution
- add excess magnesium ribbon
- record the highest temperature of the mixture
- repeat the experiment using excess copper turnings, then using excess zinc foil.

(i) State a suitable container for the iron(II) sulfate solution in this experiment.

metal beaker

(1)

(ii) State what the student should do to the mixtures during the experiment.

Keep them covered

(1)

Q3 b ii. Why is this wrong?

(iii) Figure 5 shows the results obtained by the student.

metal added to iron(II) sulfate solution	temperature rise/°C
magnesium	6.0
copper	0.0
zinc	2.8

Figure 5

Explain how the student could improve the method to make a fairer comparison of the temperature change produced by the different metals.

She could ~~also~~ do the same thing with each element ~~but~~ she is using multiple times.

(2)

Q3 b iii. Why is this wrong? Think about the metals and why they make it an unfair test.

(iv) The iron(II) sulfate solution contained 6.2 g of iron(II) sulfate in 50 cm³ of solution.

Calculate the concentration of the iron(II) sulfate solution in g dm⁻³.

$$50 \div 6.2 = 8.06$$

(2)

Q3 b iv. Why is this wrong? How do we calculate concentration?

concentration = 8.06 g dm⁻³

(Total for Question 3 = 7 marks)

(1)

Q3 a. Endothermic

(a) When a solid amount of ammonium chloride is shaken with water, a colourless solution forms and the temperature changes from 20°C to 16°C.

Give the name of the type of heat change occurring.

decrease

(1)

(b) A student carries out an experiment to measure accurately the temperature changes when different metals are added to iron(II) sulfate solution.

The method for the experiment is:

- measure 25 cm³ of iron(II) sulfate solution and pour into a container
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(i) State a suitable container for the iron(II) sulfate solution in this experiment.

metal beaker

(1)

(ii) State what the student should do to the mixtures during the experiment.

Keep them covered

(1)

Q3 b i.

- beaker
- polystyrene cup
- conical flask

Q3 b ii. Stir the mixtures

Q3 b iv.

Concentration g/dm³ = mass (g)/volume (dm³)
So.. Concentration = 6.2 / 0.05
= 124g/dm³

(iii) Figure 5 shows the results obtained by the student.

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Figure 5

Explain how the student could improve the method to make a fairer comparison of the temperature change produced by the different metals.

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(iv) The iron(II) sulfate solution contained 6.2g of iron(II) sulfate in 50 cm³ of solution.

Calculate the concentration of the iron(II) sulfate solution in g dm⁻³.

$$So \div 6.2 = 8.06$$

(2)

concentration = 8.06 g dm⁻³

(Total for Question 3 = 7 marks)

(1)

Q3 b iii. Metals are all different sized pieces. Use powdered metals to make it a fairer test as they will then have similar/same size particles/surface area and shape.

Answers!

Question number	Answer	Mark
3(a)	endothermic	(1)

Question number	Answer	Mark
3(b)(i)	Any one from: <ul style="list-style-type: none"> • beaker (1) • polystyrene cup (1) • conical flask (1) 	(1)

Question number	Answer	Mark
3(b)(ii)	Stir the mixtures with the thermometer	(1)

Question number	Answer	Additional guidance	Mark
3(b)(iv)	An explanation that combines identification – improvement of the experimental procedure (1 mark) and justification/reasoning which must be linked to the improvement (1 mark): <ul style="list-style-type: none"> • use magnesium, zinc and copper as powders (1) • so they have the same/similar size particles/surface area/shape (1) 	allow other acceptable answers, e.g. use same mass / no moles of each	(2)

Question number	Answer	Additional guidance	Mark
3(b)(v)	1000 cm ³ contain $\frac{6.2 \times 1000}{50}$ (1) 1 dm ³ contains 124 (g dm ⁻³) (1)	Award full marks for correct numerical answer without working.	(2)

Now try this!

Q1. Some people use a hand warmer to warm their hands in winter.



(a) A chemical reaction takes place in the hand warmer.
This reaction gives out heat energy.
Give the name for reactions that give out heat energy.

(1)

(b) When ammonium nitrate crystals are dissolved in water, heat energy is taken in.
A student puts some water in a beaker.
He puts a thermometer in the water.
He adds some ammonium nitrate crystals

State what the student should do to the mixture during the experiment.

(1)

(c) Describe what the student would see during the experiment.

(2)

(e) The ammonium nitrate solution contained 15.2g of ammonium nitrate in 40cm³ of solution.

Calculate the concentration of the ammonium sulphate solution in gdm⁻³

(2)

Concentration = _____ gdm⁻³

(Total for Question is 6 marks)

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(e) The ammonium nitrate solution contained 15.2g of ammonium nitrate in 40cm³ of solution.

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(2)

Concentration = gdm⁻³

(Total for Question is 6 marks)

Mark Scheme

Q1.

	Answer	Acceptable answers	Mark
(a)	exothermic	exthermic exothermal	(1)
(b)	Stir the mixture		(1)
(c)	A description including any two of temperature (1) falls /decreases / lowers (1) crystals disappear (1) solution (formed) (1)	reading on thermometer water becomes colder ignore dissolves ignore fizzing and any other incorrect observations	(2)
(d)	$\frac{15.2}{40} \times 1000 = 380 \text{ gdm}^{-3}$		(2)