New Document 1

Name: _____

Class: _____

Date: _____

Time: **36 minutes**

Marks: **35 marks**

Comments:

Q1.

This question is about the reactions of acids.

(a) When dilute hydrochloric acid is reacted with sodium hydroxide solution there is a temperature change.

Explain how the temperature changes.

_____

_____

_____

_____

(2)

(b) Acids produce hydrogen ions in aqueous solutions.

What is the ionic equation for neutralisation reactions?

Tick **one** box.

$H^+(aq) + H_2O(l) \rightarrow H_3O^+(aq)$ ☐

$H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$ ☐

$2\ H_2O(l) \rightarrow H_3O^+(aq) + OH^-(aq)$ ☐

$H_2O(l) \rightarrow 2\ H^+(aq) + O^{2-}(aq)$ ☐

(1)

(c) Sulfuric acid reacts with copper carbonate to produce a salt, water and carbon dioxide.

$$H_2SO_4 + CuCO_3 \longrightarrow CuSO_4 + H_2O + CO_2$$

What is the name of the salt produced?

_____

(1)

(d) A student reacted four metals with water and with a dilute acid to work out the order of reactivity of the metals.

The table below shows some of the observations.

Metal	Reaction with water	Reaction with dilute acid
Calcium	Bubbles of gas	**X**

Copper	**Y**	No bubbles of gas
Magnesium	Few bubbles of gas	Bubbles of gas
Zinc	No bubbles of gas	Bubbles of gas

Write the observations for **X** and **Y**.

Observation at **X** _____

Observation at **Y** _____

(2)

(e) Write the four metals, calcium, copper, magnesium and zinc, in order of reactivity.

Start with the **most** reactive metal.

_____ _____ _____ _____

(2)

(f) Some gases given off in reactions can be identified by chemical tests.

Draw **one** line from each chemical test to the name of the gas.

Chemical test	**Gas**
Put in a lighted splint. The gas burns with a pop sound.	Carbon dioxide
	Chlorine
Put in a glowing splint. The gas relights the splint.	Hydrogen
	Nitrogen
Put into limewater. The gas turns limewater cloudy.	Oxygen

(3)

(g) Acids react with bases to produce salts and water (H_2O).

The electronic structure of a hydrogen atom is 2,1

The electronic structure of an oxygen atom is 2,6

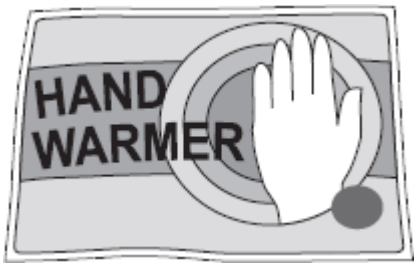
Draw a diagram to show the arrangement of the outer shell electrons in a molecule of water.

(2)

(Total 13 marks)

Q2.

Hand warmers use chemical reactions.



(a) The table shows temperature changes for chemical reactions **A**, **B** and **C**.

Reaction	Starting temperature in °C	Final temperature in °C	Change in temperature in °C
A	18	25	+ 7
B	17	_____	+ 5
C	18	27	+ 9

What is the final temperature for reaction **B**? Write your answer in the table.

(1)

(b) (i) What name is given to reactions that heat the surroundings?

_____

(1)

(ii) Which reaction, **A**, **B** or **C**, would be best to use in a hand warmer?

Reaction ☐

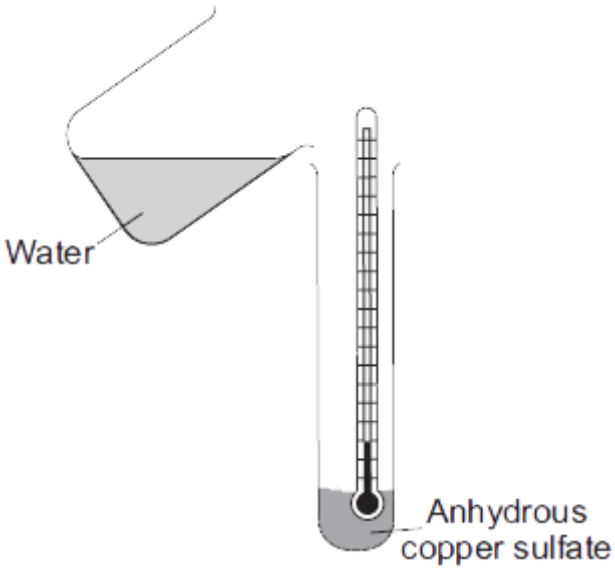
Give a reason why you chose this reaction.

_____

_____

(2)

(c) A student added water to some anhydrous copper sulfate.



The equation for the reaction is shown.

anhydrous copper sulfate + water ⇌ hydrated copper sulfate

$CuSO_4$ + 5 H_2O ⇌ $CuSO_4.5H_2O$

The student measured the temperature before and after the reaction.

(i) The measurements showed that this reaction can be used for a hand warmer.

Draw a ring around the correct answer to complete the sentence.

When water is added to anhydrous copper sulfate the temperature

of the mixture

increases.
decreases.
stays the same.

(1)

(ii) Anhydrous copper sulfate is white.

What colour is seen after water is added to the anhydrous copper sulfate?

_____

(1)

(iii) What does the symbol ⇌ mean?

_____

(1)

(iv) The student heated a tube containing hydrated copper sulfate.

Name the solid substance produced.

_____

(1)

(Total 8 marks)

Q3.

Hydrogen peroxide decomposes slowly to give water and oxygen.

The reaction is *exothermic*.

$$2H_2O_2 \rightarrow 2H_2O + O_2$$

(a) In an *exothermic* reaction, energy is given out.

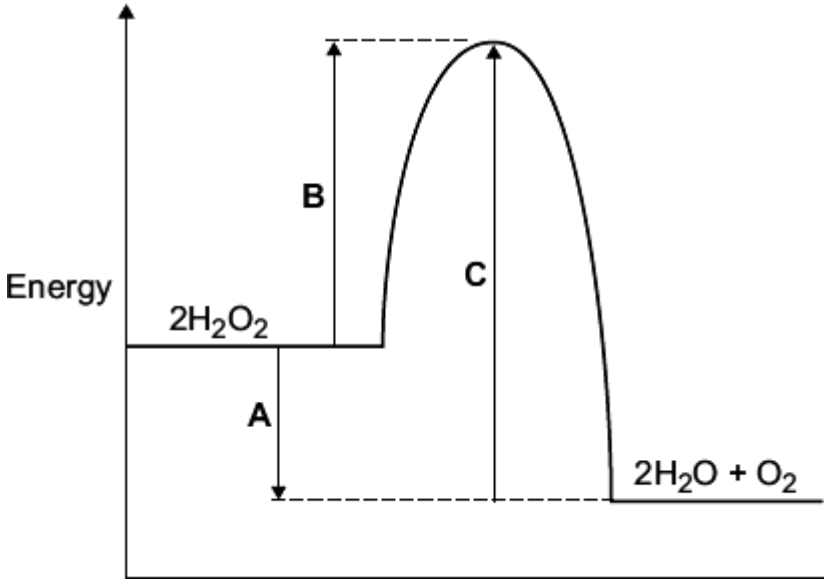
Draw a ring around the correct answer to complete the sentence.

In an *exothermic* reaction, the temperature

- goes down.
- goes up.
- stays the same.

(1)

(b) The energy level diagram for this reaction is shown below.



The energy changes, **A**, **B** and **C**, are shown on the diagram.

Use the diagram to help you answer these questions.

(i) Which energy change, **A**, **B** or **C**, is the activation energy? ☐

(1)

(ii) Which energy change, **A**, **B** or **C**, shows that this reaction is exothermic? ☐

(1)

(iii) Hydrogen peroxide decomposes quickly when a small amount of manganese(IV) oxide is added.

Draw a ring around the correct answer to complete each sentence.

Hydrogen peroxide decomposes quickly because

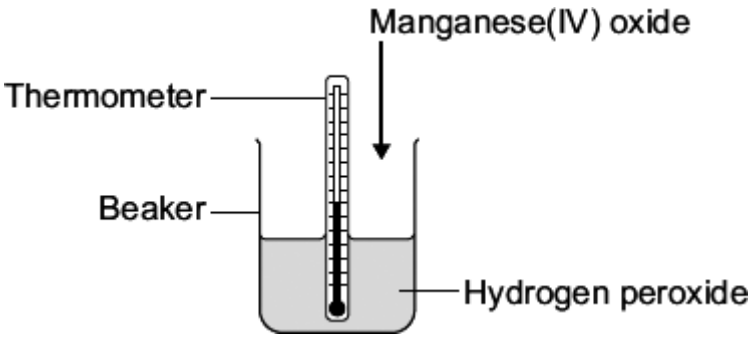
manganese(IV) oxide is	a catalyst. an element. a solid.

The manganese(IV) oxide has lowered the	activation energy. boiling point. temperature.

(2)

(c) A student did an experiment to find the amount of energy produced when hydrogen peroxide solution is decomposed using manganese(IV) oxide.

The apparatus the student used is shown in the diagram.



The student first measured the temperature of the hydrogen peroxide. Then the student added the manganese(IV) oxide, stirred the mixture and recorded the highest temperature.

(i) Suggest why the student stirred the mixture before recording the highest temperature.

_____

_____

(1)

(ii) The biggest error in this experiment is heat loss.

Suggest how the student could change the apparatus so that less heat is lost.

_____

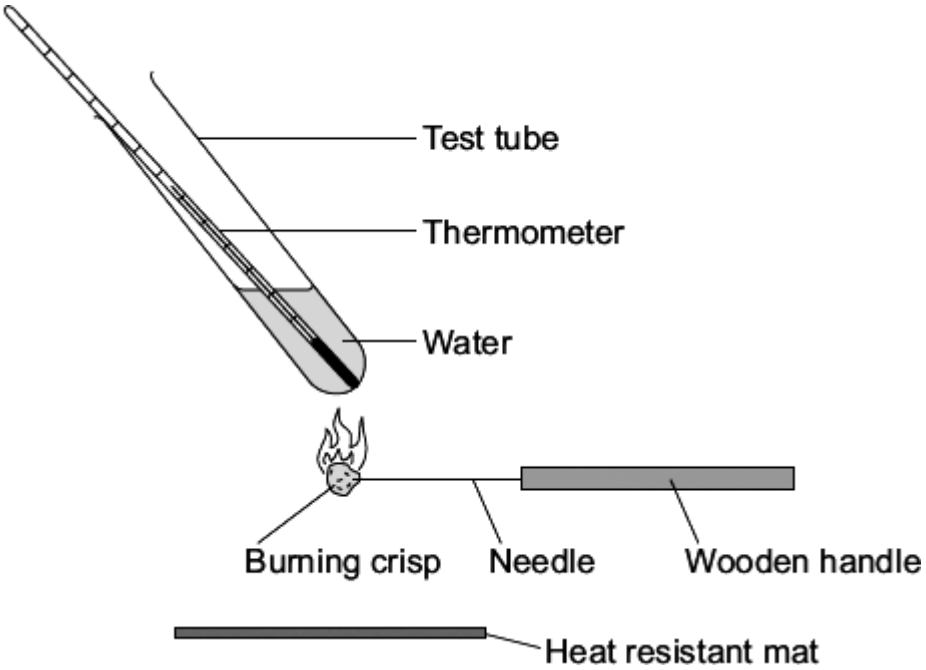
_____

(1)

(Total 7 marks)

Q4.

A student investigated the amount of energy released when four different makes of plain salted crisps were burned.



The following method was used for each make of plain salted crisp. The pieces of crisp were all the same size.

- The starting temperature of the water was measured.
- The piece of crisp was burned underneath the test tube.
- The final temperature of the water was measured.

(a) The results of the investigation are shown in the table.

	Make 1	**Make 2**	**Make 3**	**Make 4**
Final temperature of the water in °C	26	25	29	25
Starting temperature of the water in °C	19	20	20	21
Temperature rise of the water in °C	7	5	9	

(i) Calculate the temperature rise for **make 4**.

_____

Temperature rise = _____ °C

(1)

(ii) Which make of crisp, **1**, **2**, **3** or **4**, releases the most energy?

Make _____

Give a reason for your answer.

_____

_____

(2)

(b) The energy needed by a student is about 9000 kJ each day.

(i) One large bag of crisps states that the energy released by the crisps is 240 kcal.

Calculate the energy of this bag of crisps in kJ.

1 kcal = 4.2 kJ

_____

_____

Answer = _____ kJ

(2)

(ii) Eating too many crisps is thought to be bad for your health.

Use the information above and your knowledge to explain why.

_____

_____

_____

_____

(2)

(Total 7 marks)

Mark schemes

Q1.

(a) it goes up / increases

1

because the reaction is exothermic **or** transfers energy to the surroundings

allow gives out thermal / heat energy

1

(b) $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

1

(c) copper sulfate

1

(d) **X** bubbles of gas

1

Y no bubbles of gas

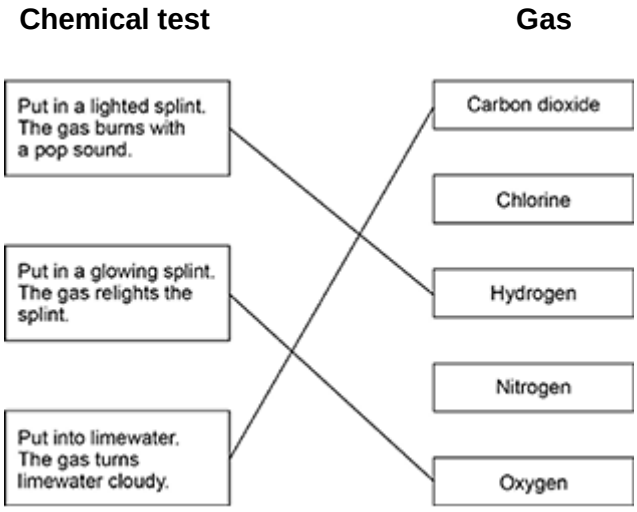
1

(e) calcium>magnesium>zinc>copper

*if not all correct allow **1** mark for at least two metals in the correct position*

2

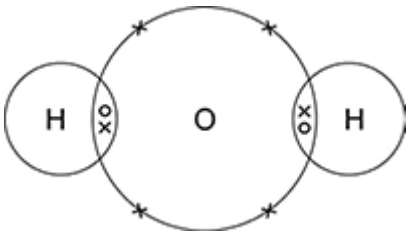
(f)



extra lines from a test negate the mark

3

(g)



two pairs of shared electrons

1

oxygen has four other electrons not bonded

1

[13]

Q2.

(a) 22

1

(b) (i) exothermic

1

(ii) C

1

gives out most heat energy

accept has largest temperature change / increase

*allow has highest (final) temperature **or** hottest*

1

(c) (i) increases

1

(ii) blue

ignore pale / dark etc

1

(iii) reversible (reaction)

*allow goes both ways **or** two / either way*

1

(iv) anhydrous copper sulfate

1

[8]

Q3.

(a) goes up

1

(b) (i) B

1

(ii) A

1

(iii) a catalyst

1

activation energy

1

(c) (i) eg (ensures) complete reaction

allow spread heat / energy

or even heating

allow mixes properly or mix them together or to get correct temperature

ignore dissolves

1

(ii) lid (on beaker)

accept cover beaker

or

insulate (beaker) / use a plastic cup

1

[7]

Q4.

(a) (i) 4

1

(ii) (Make) 3

1

biggest <u>temperature</u> <u>rise</u>

1

(b) (i) 1008 (kJ)

*correct answer with or without working gains **2** marks*

*if incorrect answer given allow evidence of 240 × 4.2 for **1** mark*

2

(ii) crisps have a high energy content

allow crisps have lots of calories / kilojoules / fat / one ninth of daily energy intake

1

so if you take in more energy than you need the excess is stored as fat

accept consequences: obesity; heart disease; high blood pressure; diabetes; arthritis

or

crisps contain salt (1)

too much salt can cause high blood pressure **or** heart problems or kidney problems (1)

1

[7]