AQA GCSE CHEMISTRY (HIGHER) · 8462

CHEMISTRY



EXAM QUESTION PACK

4.5.1 EXOTHERMIC AND ENDOTHERMIC REACTIONS (PACK 3)

SCORE	PERCENTAGE
/208	%

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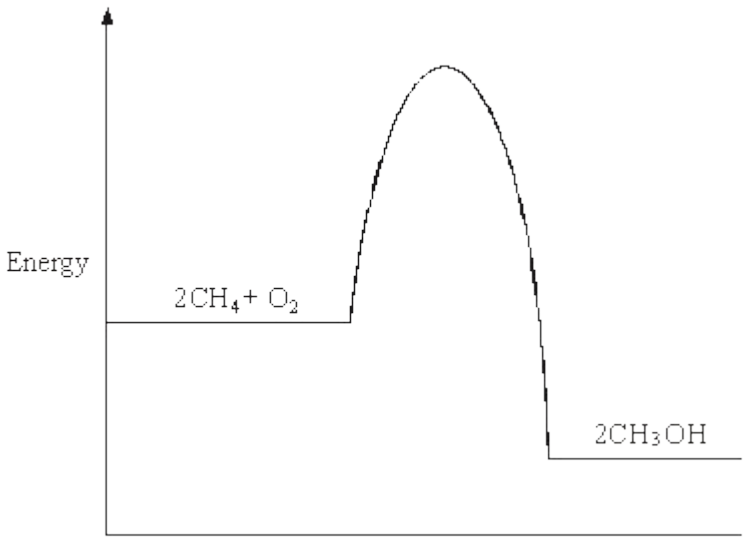
Q1.

Methanol (CH_3OH) can be made by reacting methane (CH_4) and oxygen (O_2) in the presence of a platinum catalyst. The reaction is exothermic.

An equation that represents the reaction is:

$$2CH_4 + O_2 \rightarrow 2CH_3OH$$

(a) The energy level diagram for this reaction is given below.



(i) Use the diagram to explain how you know that this reaction is exothermic.

_____

_____

_____

(1)

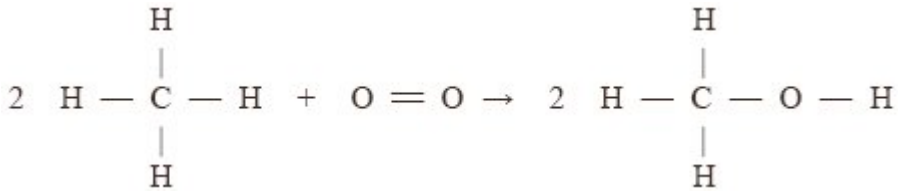
(ii) Explain, in terms of the energy level diagram, how the platinum catalyst increases the rate of this reaction.

_____

_____

(1)

(b) The equation can also be written showing the structural formulae of the reactants and the product.



(i) Use the bond energies given in the table to help you to calculate the energy change for this reaction.

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Bond	Bond energy in kJ
C — H	435
O = O	498
C — O	805
O — H	464

_____

_____

_____

_____

_____

Energy change = _____ kJ

(3)

(ii) In terms of the bond energies, explain why this reaction is exothermic.

_____

_____

(1)

(Total 6 marks)

Q2.

The reaction of methane with steam is used in industry to make hydrogen.

(a) One of the reactions in this process is represented by this equation.

CH_4 (g) + H_2O ⇌ CO (g) + $3H_2$ (g)

The forward reaction is endothermic.

State the conditions of temperature and pressure that would give the maximum yield of hydrogen.

Explain your answers.

(i) Temperature

_____

_____

_____

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_____

(2)

(ii) Pressure

_____

_____

_____

_____

(2)

(iii) Which one of the following metals is most likely to be a catalyst for this process? Draw a ring around your answer.

aluminium **lead** **magnesium** **nickel** **sodium**

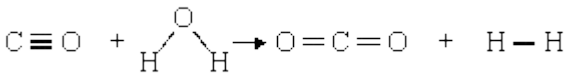
Give a reason for your choice.

_____

_____

(1)

(b) A second stage in this process is represented by this equation.



(i) Use the bond energies given in the table to help you to calculate the nett energy transfer (energy change) for this reaction.

Bond	Bond energy in kJ/mol
C º O	1077
C = O	805
H – H	436
O – H	464

_____

_____

_____

_____

_____

_____

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Nett energy transfer = _____ kJ/mol

(3)

(ii) State whether this reaction is exothermic or endothermic. _____

Explain, by reference to your calculation, how you know.

_____

_____

_____

_____

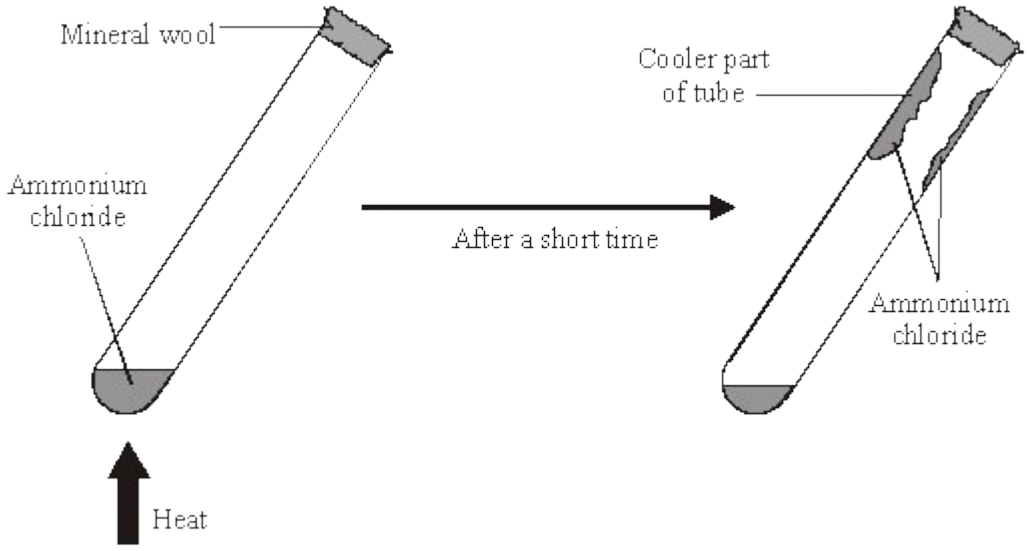
(2)

(Total 10 marks)

Q3.

A student did two experiments using ammonium chloride.

(a) In the first experiment the student heated a small amount of ammonium chloride in a test tube.



Two reactions take place in the test tube.

Reaction **1**	ammonium chloride → ammonia + hydrogen chloride (colourless gases)
Reaction **2**	ammonia + hydrogen chloride → ammonium chloride

(i) Complete the sentences by crossing out the **incorrect** word in each box.

Reaction **1** takes place at a [high / low] temperature.

Reaction **2** takes place at a [high] temperature.

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low

(1)

(ii) Draw a ring around the word which best describes reactions **1** and **2**.

combustion displacement oxidation reduction reversible

(1)

(iii) Suggest a reason for the mineral wool at the top of the test tube.

_____

_____

(1)

(b) In the second experiment the student mixed a small amount of ammonium chloride with some water in a beaker.

The temperature of the water was measured before and after adding the ammonium chloride.

Temperature before adding the ammonium chloride	20°C
Temperature after adding the ammonium chloride	16°C

Draw a ring around the word which best describes the process which takes place.

combustion displacement endothermic exothermic freezing

(1)

(Total 4 marks)

Q4.

Silicon is an important element used in the electronics industry.

(a) Silicon can be made by heating a mixture of sand (silicon dioxide) with magnesium powder.

The equation for this reaction is shown below.

$$SiO_2\ (s) + 2Mg\ (s) \rightarrow 2MgO\ (s) + Si\ (s)$$

Calculate the mass of silicon dioxide needed to make 1 g of silicon.

Relative atomic masses: O = 16; Si = 28

_____

_____

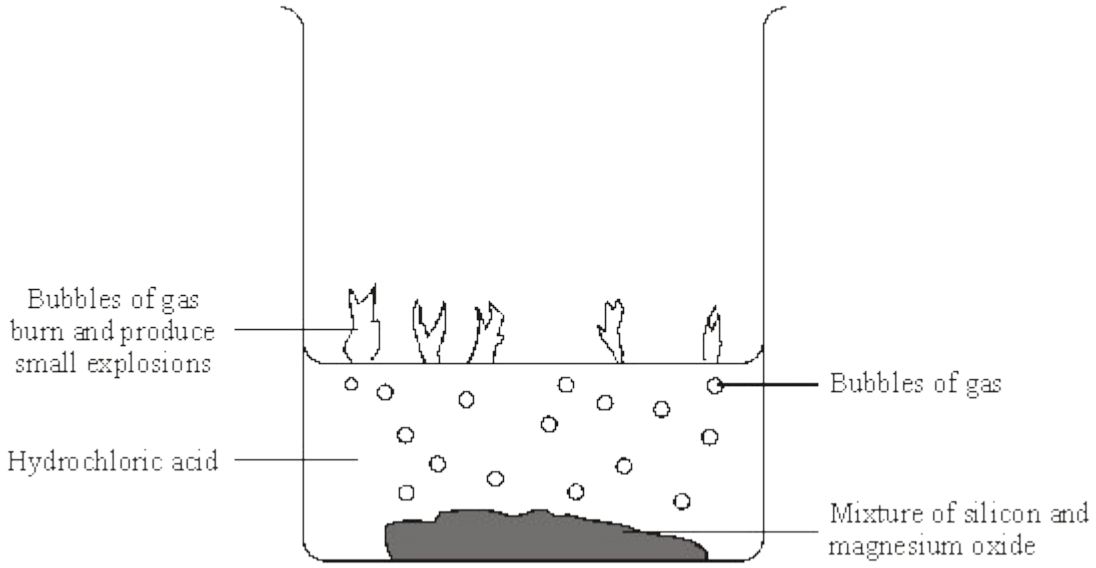
_____

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Mass = _____g

(3)

(b) The resulting mixture of magnesium oxide and silicon is added to a beaker containing hydrochloric acid. The silicon is then filtered from the solution.



(i) The magnesium oxide reacts with the hydrochloric acid and forms magnesium chloride ($MgCl_2$) solution and water.

magnesium oxide + hydrochloric acid → magnesium chloride solution + water

Write a balanced symbol equation for this reaction, including state symbols.

_____

(2)

(ii) The gases produced are a mixture of several silicon hydrides.

One of the gases produced in the reaction is the silicon hydride with the formula SiH_4. The structure of this molecule is similar to methane, CH_4.

Draw a diagram to show the bonding in a molecule of SiH_4. Represent the electrons as dots and crosses and only show the outer shell (energy level) electrons.

(1)

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(iii) A sample of a different silicon hydride was found to contain 1.4 g of silicon and 0.15 g of hydrogen.

Calculate the formula of this silicon hydride. You must show all your working to gain full marks.

Relative atomic masses: H = 1; Si = 28

_____

_____

_____

_____

_____

_____

_____

(4)

(iv) The silicon hydrides react immediately they come into contact with oxygen in the air. They burst into flames with a small explosion and give out energy.

Which letter, **A** to **H**, best describes this reaction?

Energy involved in breaking and forming bonds	Activation energy	Rate of reaction	Letter
The energy released from forming new bonds is greater than the energy needed to break existing bonds	high	fast	**A**
		slow	**B**
	low	fast	**C**
		slow	**D**
The energy needed to break existing bonds is greater than the energy released from forming new bonds	high	fast	**E**
		slow	**F**
	low	fast	**G**
		slow	**H**

Letter _____

(1)

(c) The structure of silicon is similar to the structure of diamond.

Describe the structure of silicon and explain why it has a high melting point. You may draw a diagram if this helps.

_____

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_____

_____

_____

_____

_____

_____

_____

(4)

(Total 15 marks)

Q5.

A student investigated some instant soup.

(a) Instant soup contains a food additive which has the formula:

NaH_2PO_4

Give the names of all the elements in this compound.

The periodic table on the Data Sheet may help you to answer this question.

_____

_____

(2)

(b) The student investigated the reaction which takes place when soup powder is added to cold water.

The student thought that the reaction might be *exothermic.*

(i) What is meant by the term *exothermic* reaction?

_____

_____

(2)

(ii) Describe an experiment that the student could do to prove that this reaction is exothermic.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

_____

_____

_____

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_____

_____

_____

_____

_____

(4)

(Total 8 marks)

Q6.

The monomer chloroethene is made from ethene in a two-stage process,

(a) The first stage is to convert ethene to 1,2-dichloroethane.

$$2C_2H_4(g) + 4HC1(g) + O_2(g) \rightleftharpoons 2C_2H_4Cl_2(g) + 2H_2O(g)$$

ethene 1,2-dichloroethane

State and explain the effect of increasing the pressure on:

(i) the yield of 1,2-dichloroethane;

_____

_____

(2)

(ii) the rate of reaction.

_____

_____

(2)

(b) In the second stage 1,2-dichloroethane is converted into chloroethene.

$C_2H_4C1_2 \rightarrow C_2H_3C1 + HCl$

This reaction is a thermal decomposition.

Suggest what would need to be done to decompose 1,2-dichloroethane.

_____

_____

(1)

(Total 5 marks)

Q7.

Some of the hydrogen and chlorine are reacted together to form hydrogen chloride.

$H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$

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Bond	Bond energy in kJ/mol
Cl–Cl	242
H–Cl	431
H–H	436

(i) Use the bond energies to calculate the energy change for the formation of hydrogen chloride.

_____

_____

_____

_____

Energy change = _____ kJ/mol

(3)

(ii) Is this reaction exothermic or endothermic? Explain your answer.

_____

_____

_____

(2)

(iii) Explain why hydrogen chloride only acts as an acid when dissolved in water.

_____

_____

_____

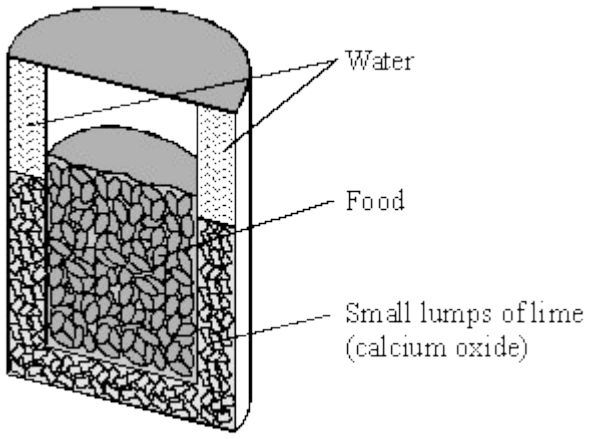
(3)

(Total 8 marks)

Q8.

Mountaineers can warm their food in self-heating, sealed containers.

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(a) The water is allowed to react with the lime. The heat from the reaction warms the food. What type of reaction causes a rise in temperature?

_____

(1)

(b) Some students investigated the effect of adding different sized lumps of lime to water. The results of their investigation are shown.

Time in minutes	Temperature in °C		
	Large lumps of lime	Small lumps of lime	Powdered lime
0	18	18	18
1	19	20	28
2	21	23	43
3	24	27	63
4	28	32	88
5	33	38	100

What do these results show? Give an explanation for your answer.

_____

_____

_____

_____

(2)

(c) Suggest and explain **one** disadvantage of using powdered lime to heat food.

_____

_____

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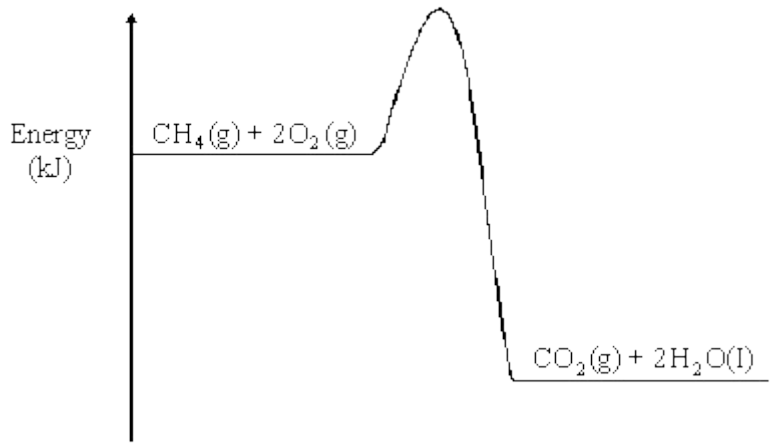
_____

(2)

(Total 5 marks)

Q9.

Many hydrocarbons are used as fuels. An energy level diagram is shown for the combustion of the hydrocarbon methane.



Describe and explain why the line rises and then falls to a lower level.

_____

_____

_____

_____

_____

_____

_____

_____

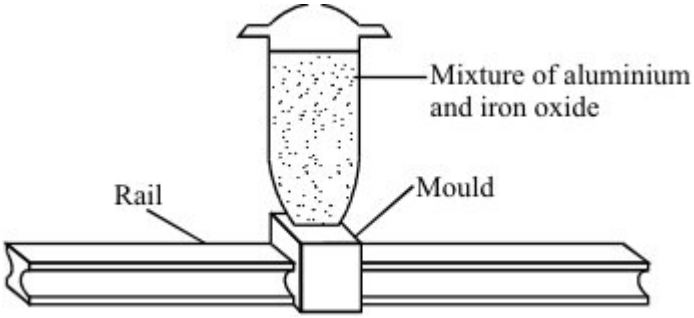
(Total 4 marks)

Q10.

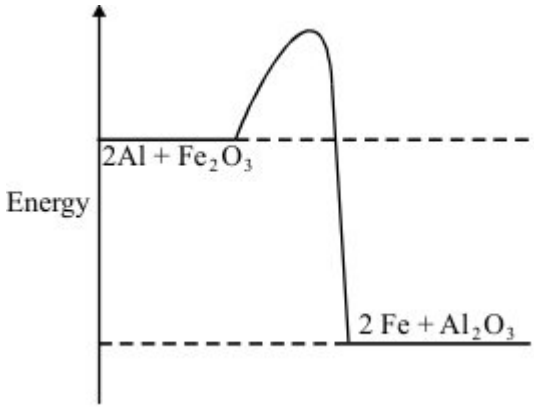
The reaction between aluminium and iron oxide is used to weld together railway lines.

$$2Al(s) + Fe_2O_3(s) \rightarrow 2Fe(l) + Al_2O_3(s)$$

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A simple, qualitative energy level diagram for this reaction is shown.



Use the energy level diagram to:

(i) describe the idea of activation energy;

_____

_____

(1)

(ii) explain why the reaction produces molten iron.

_____

_____

_____

_____

(2)

(Total 3 marks)

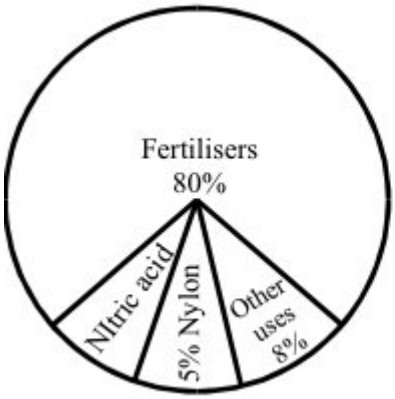
Q11.

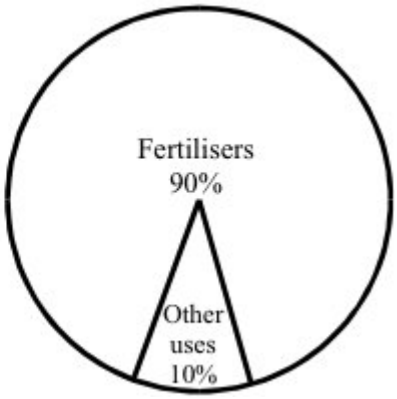
Ammonia and nitric acid are both important chemicals. Nitric acid is made from ammonia.

The charts below show substances made from ammonia and nitric acid.

Substances made from ammonia	Substances made from nitric acid

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(a) Use the charts to help you answer these questions.

(i) What is the main use of both ammonia and nitric acid?

_____

(1)

(ii) Work out the percentage of ammonia used to make nitric acid.

Percentage = _____ %

(1)

(iii) 100 million tonnes of ammonia are made in the world each year.

How much of this ammonia is used to make nylon?

_____ million tonnes

(1)

(b) The word equations below show how nitric acid is made.

1. nitrogen + hydrogen → ammonia
2. ammonia + oxygen → nitrogen monoxide + water
3. nitrogen monoxide + oxygen → nitrogen dioxide
4. nitrogen dioxide + water → nitric acid

Use the word equations to help you answer these questions.

(i) From which **two** elements is ammonia made?

_____ and _____

(1)

(ii) Name **two** of the raw materials needed to make nitric acid.

_____ and _____

(2)

(c) A large amount of nitric acid is reacted with ammonia to make a fertiliser.

nitric acid + ammonia → fertiliser

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(i) The reaction is a neutralisation reaction.

What type of chemical must ammonia be?

_____

(1)

(ii) Complete the chemical name for the fertiliser made from ammonia and nitric acid.

ammonium _____

(1)

(iii) The reaction of nitric acid with ammonia is exothermic.

Name the piece of equipment you could put into the solution to prove that the reaction is exothermic.

_____

(1)

(Total 9 marks)

Q12.

The word equation below shows a reaction used in an industrial process.

chromium oxide + aluminium → chromium + aluminium oxide

The reaction is highly exothermic.

(a) What is an exothermic reaction?

_____

_____

(2)

(b) Name the products of this reaction.

_____

(1)

(c) In the reaction one substance is reduced.

(i) Name the substance which is reduced.

_____

(1)

(ii) What happens to the substance when it is reduced?

_____

_____

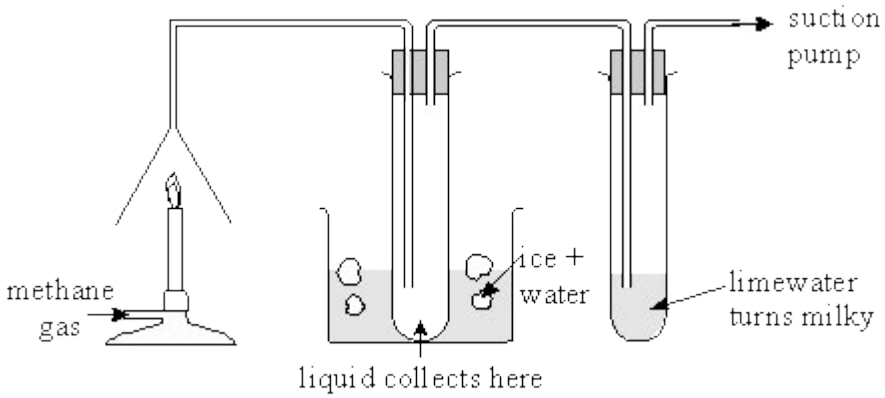
(1)

(Total 5 marks)

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Q13.

Methane CH_4 contains the elements carbon and hydrogen only. A student wanted to find out which new substances are produced when methane is burned. The student set up the apparatus shown below.



(a) Which gas in the air reacts with methane when it burns?

_____

(1)

(b) Name the liquid collected.

_____

(1)

(c) Name the gas which turns limewater milky.

_____

(1)

(d) When methane burns an exothermic reaction takes place. What is meant by an exothermic reaction?

_____

_____

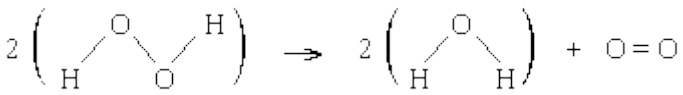
(2)

(Total 5 marks)

Q14.

At room temperature, hydrogen peroxide decomposes very slowly to form water and oxygen.
The decomposition is speeded up when a catalyst is added.

(a) The following equation represents the decomposition of hydrogen peroxide.
The structural formulae of the chemicals involved are shown.



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Use the following information about bond energies to answer this part of the question.

BOND	BOND ENERGY (kJ)
O = O	498
O – O	146
H – O	464

(i) Calculate the energy needed to break all the bonds in the reactants.

_____

_____

_____

_____ kJ

(2)

(ii) Calculate the energy released when new bonds are formed in the products.

_____

_____

_____

_____ kJ

(2)

(iii) Calculate the energy change for this reaction.

_____

_____ kJ

(1)

(iv) Is the reaction exothermic or endothermic?

_____

Explain why.

_____

_____

(1)

(b) (i) What is meant by ‘activation energy’?

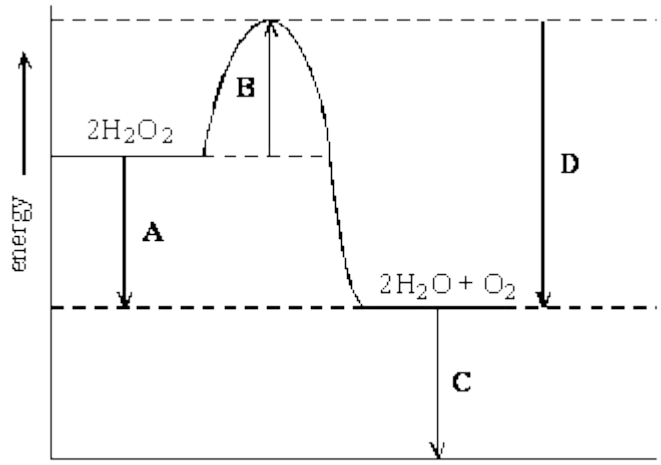
_____

_____

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(1)

(ii) The energy level diagram for the decomposition of hydrogen peroxide into water and oxygen is shown below.



Which energy change, **A**, **B**, **C** or **D**, is the activation energy? _____

(1)

(iii) Explain, in terms of energy, how a catalyst makes hydrogen peroxide decompose more quickly.

_____

_____

_____

(1)

(Total 9 marks)

Q15.

(i) Which acid from the list should the student add to sodium hydroxide solution to make sodium sulphate?

ethanoic acid **hydrochloric acid** **nitric acid** **sulphuric acid**

_____

(1)

(ii) When the acid was added to the alkali the beaker became warm.
Name the type of reaction that releases heat.

_____

(1)

(iii) Use the Data Sheet to help you to write the formula of sodium sulphate.

Formula: _____

(1)

(Total 3 marks)

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Q16.

(a) (i) Which acid should the student add to sodium hydroxide solution to make sodium sulphate?

_____ acid

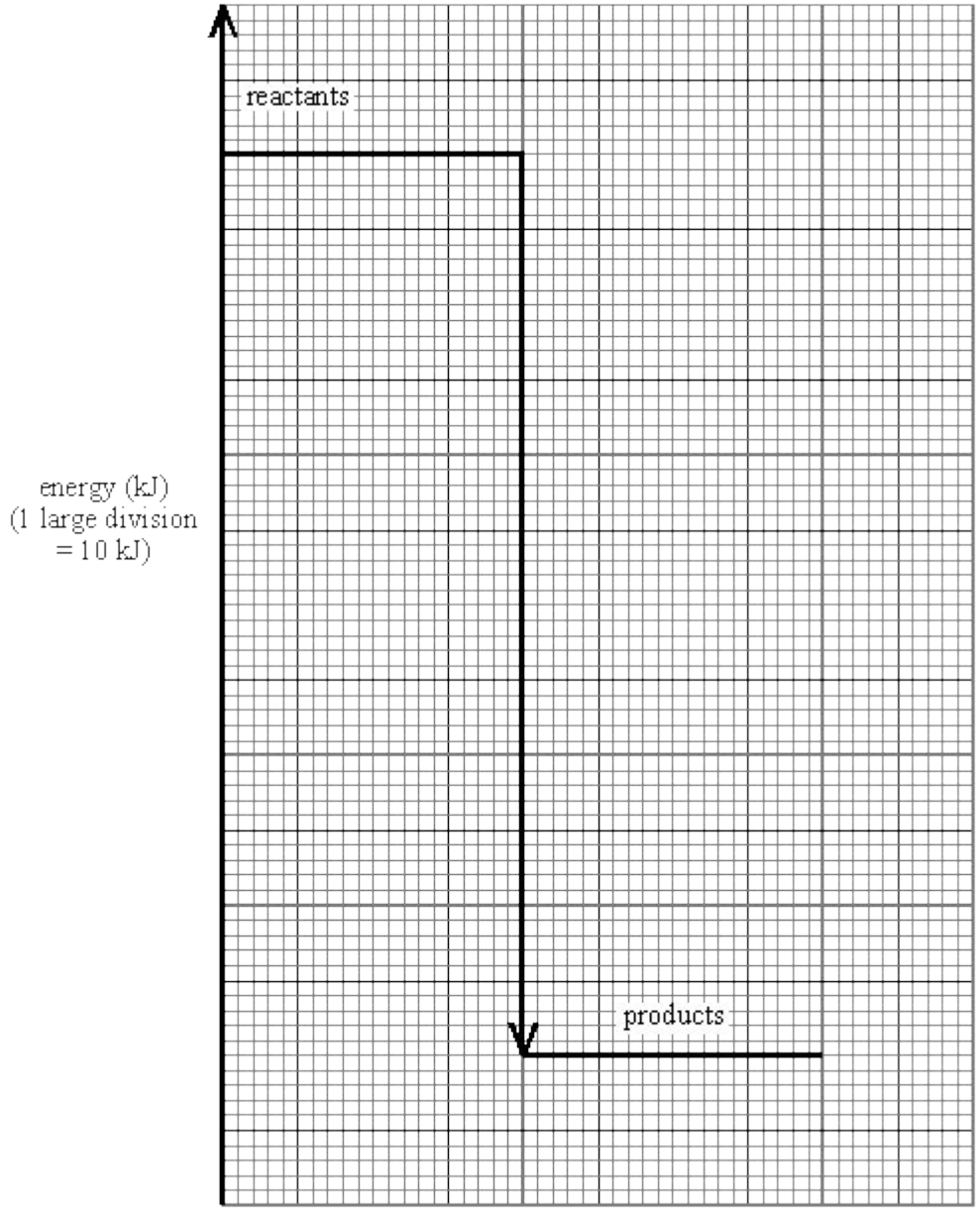
(1)

(ii) Use the table on the Data Sheet to help you to write the formula of sodium sulphate.

Formula: _____

(1)

(b) The student noticed that the solution in the beaker got warm when the acid reacted with the alkali.
The energy diagram below represents this reaction.



(i) In terms of **energy**, what type of reaction is this?

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_____

(1)

(ii) Use the energy diagram to calculate a value for the amount of energy released during this reaction.

_____

Energy released _____ kJ

(1)

(iii) Explain, in terms of bond breaking and bond forming, why energy is released during this reaction.

_____

_____

_____

_____

(3)

(iv) The reaction takes place very quickly, without the help of a catalyst. What does this suggest about the activation energy for this reaction?

_____

_____

(1)

(Total 8 marks)

Q17.

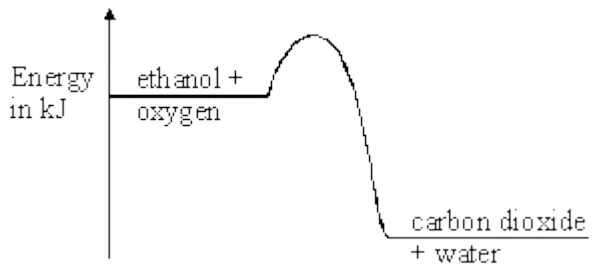
Ethanol is used as a fuel.

(a) Balance the symbol equation for the combustion reaction.

$C_2H_5OH + O_2 \rightarrow CO_2 + H_2O$

(1)

(b) The energy level diagram represents the combustion of ethanol.



Describe what must happen to the molecules of ethanol and oxygen to allow them to react.

_____

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_____

_____

_____

_____

_____

(3)

(c) We can use bond energies to calculate the energy change for the reaction between hydrogen and oxygen.

$$2H_2 + O_2 \rightarrow 2H_2O$$

Bond	Bond energy in kJ
H – H	436
O – H	464
O = O	498

(i) Calculate the total bond energy of the reactants.

_____

_____

_____

Total bond energy of reactants = _____ kJ

(2)

(ii) Is the reaction between hydrogen and oxygen exothermic or endothermic? Use bond energies to explain your answer.

_____

_____

_____

_____

_____

_____

_____

(2)

(Total 8 marks)

Q18.

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Hydrogen chloride is made by reacting hydrogen with chlorine.

$H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$

Bond	Bond energy in kJ
H – H	436
Cl – Cl	242
H – Cl	431

Is the reaction between hydrogen and chlorine exothermic or endothermic?
Use the bond energies to explain your answer.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(Total 3 marks)

Q19.

In the Haber process, nitrogen and hydrogen react to make ammonia.

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

nitrogen + hydrogen $\rightleftharpoons$ ammonia

Pressure in atmospheres	% ammonia present at equilibrium				
	Temperature in ºC				
	100	**200**	**300**	**400**	**500**
10	88.2	50.7	14.7	3.9	1.2
25	91.7	63.6	27.4	8.7	2.9

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50	94.5	74.0	39.5	15.3	5.6
100	96.7	81.7	52.5	25.2	10.6
200	98.4	89.0	66.7	38.8	18.3
400	99.4	94.6	79.7	55.4	31.9
1000	99.9	98.3	92.6	79.8	57.5

The actual conditions used in the Haber process are usually 450 °C and 200 atmospheres.

(a) What effect does increasing the pressure have on the percentage of ammonia made? Use the balanced symbol equation to explain why.

_____

_____

_____

_____

_____

_____

(2)

(b) A lower temperature of 100 °C gives high percentages of ammonia at most pressures. Why is this temperature **not** used in the Haber process?

_____

_____

_____

(1)

(c) Describe and explain the effect of an increase in the temperature on the reaction between nitrogen and hydrogen in the Haber process.

_____

_____

_____

_____

_____

_____

_____

_____

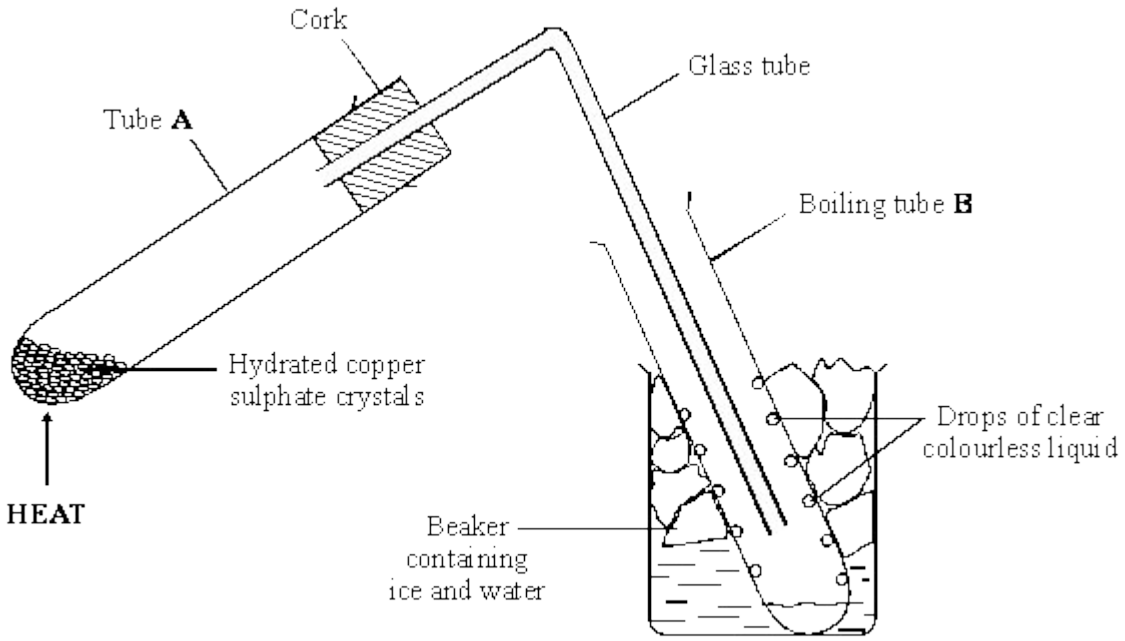
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(3)

(Total 6 marks)

Q20.

The diagram shows the apparatus for an experiment. Hydrated copper sulphate crystals were heated. They became anhydrous copper sulphate.



(a) Name a suitable piece of equipment to heat tube **A**.

_____

(1)

(b) Use words from the box to complete the **two** spaces in the table. You may use each word once or not at all.

black	blue	orange	red	purple	white

Name	Colour
Hydrated copper sulphate crystals	_____
Anhydrous copper sulphate	_____

(2)

(c) What is the purpose of the ice and water in the beaker?

_____

_____

(1)

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(d) Drops of a clear, colourless liquid formed on the inside of tube **B**.

(i) Name the liquid.

_____

(1)

(ii) Explain how the liquid came to be inside tube **B**.

_____

_____

_____

(2)

(e) Anhydrous copper sulphate can be turned into hydrated copper sulphate. What would you need to add? Apart from the change in colour, what could you observe?

_____

_____

_____

(2)

(f) Copper sulphate can be made from black copper oxide by reacting it with an acid. Name the acid.

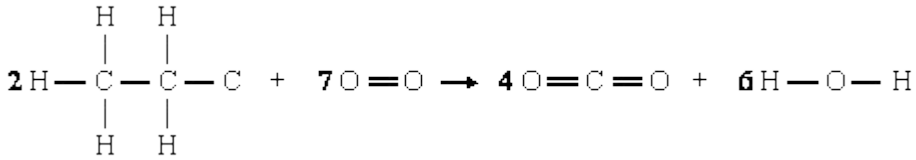
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(1)

(Total 10 marks)

Q21.

The balanced equation for the combustion of ethane is shown using structural formulae.



(a) Complete the table to show the number of bonds broken and made when two molecules of ethane react with seven molecules of oxygen.

Type of bond	Number of bonds broken	Number of bonds made
C — C		
C — H		
O = O		
C = O		

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H — O		

(2)

(b) The combustion of ethane is a strongly exothermic process. Draw a labelled energy level diagram showing the endothermic and exothermic parts of the overall reaction. Indicate the activation energy on the diagram.

(4)

(c) Explain, in terms of particles and the activation energy of a reaction, how a catalyst is able to increase the rate of reaction.

_____

_____

_____

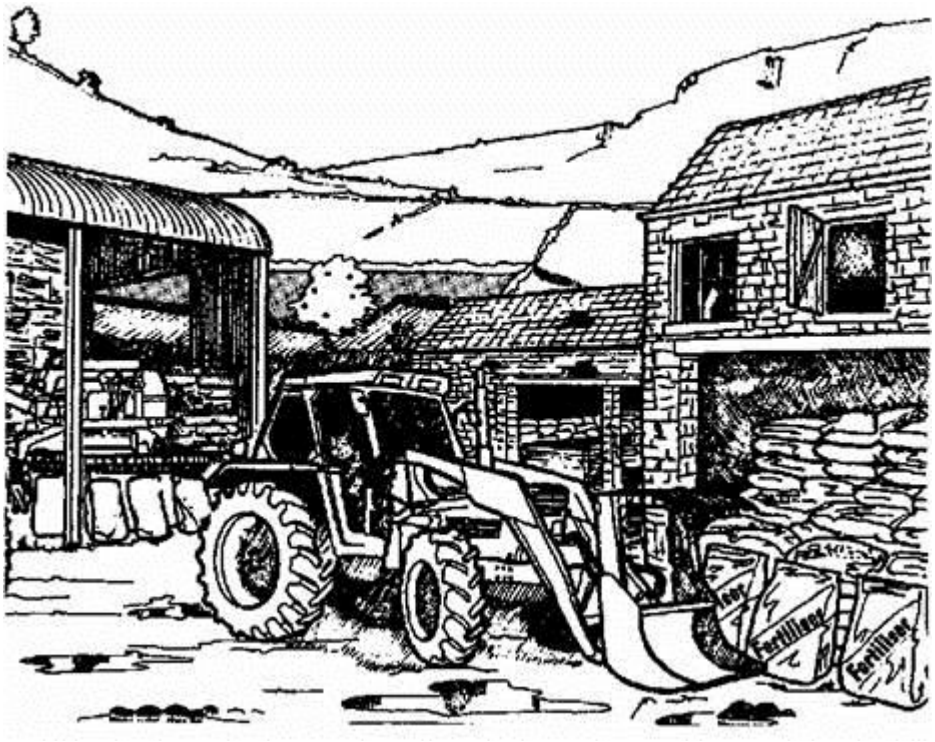
_____

(2)

(Total 8 marks)

Q22.

Ammonium nitrate and ammonium sulphate are used as fertilisers.



(i) Which acid reacts with ammonia to form ammonium nitrate?

_____

(1)

(ii) Which acid reacts with ammonia to form ammonium sulphate?

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_____

(1)

(iii) The reactions in (i) and (ii) are both exothermic. How can you tell that a reaction is exothermic?

_____

_____

(1)

(iv) The reactions in (i) and (ii) are both examples of acid + base reactions. What is the name of the chemical change which takes place in every acid + base reaction?

_____

(1)

(Total 4 marks)

Q23.

Wax is a fuel.

A young child watched a candle burning and wondered where the wax had gone.



(a) Complete the sentence below.

When wax burns, energy is released as _____

(1)

(b) Why does the wax disappear as it burns?

_____

_____

(1)

(Total 2 marks)

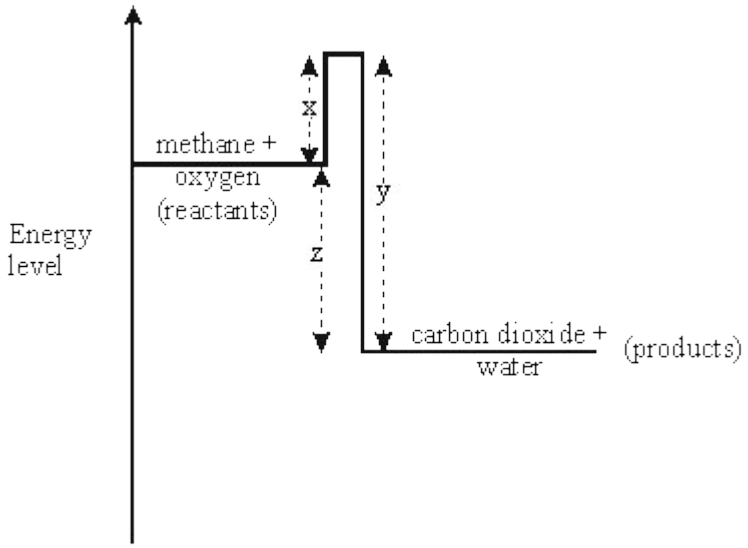
Q24.

The symbol equation below shows the reaction when methane burns in oxygen.

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

An energy level diagram for this reaction is shown below.

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(a) Which chemical bonds are broken and which are formed during this reaction?

_____

_____

_____

_____

_____

(4)

(b) Explain the significance of x, y and z on the energy level diagram in terms of the energy transfers which occur when these chemical bonds are broken and formed.

_____

_____

_____

_____

_____

_____

_____

(5)

(Total 9 marks)

Q25.

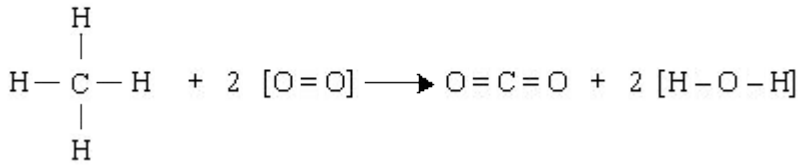
The symbol equation shows the reaction between methane and oxygen.

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

methane oxygen carbon dioxide water

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The structural formulae in the equation below show the bonds in each molecule involved.



In the three stages shown at (i), (ii) and (iii) below, calculate the net energy transfer when the formula mass (1 mole) of methane reacts with oxygen.

(i) Write down the bonds broken and the bonds formed during the reaction.

Bonds broken		**Bonds formed**	
number	**type**	**number**	**type**

(4)

(ii) Calculate the total energy changes involved in breaking and in forming each of these bonds.

Total energy change in breaking bonds	**Total energy change in forming bonds**

(4)

(iii) Describe, as fully as you can, what the above figures in (ii) tell you about the overall reaction.

_____

_____

_____

_____

_____

(2)

(Total 10 marks)

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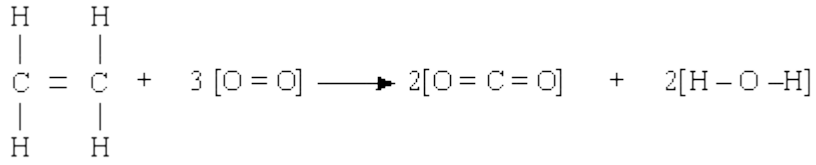
Q26.

You will find the information on the Data Sheet helpful when answering this question.

This equation shows the reaction between ethene and oxygen.

$C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$

The structural formulae in the equation below show the bonds in each molecule involved.



Use the three stages shown at (a), (b) and (c) below to calculate the nett energy transfer when the formula mass (1 mole) of ethene reacts with oxygen.

(a) Write down the bonds broken and the bonds formed during the reaction. (Some have already been done for you.)

Bonds broken	
Number	Type
4	[C – H]
1	[C = C]

Bonds formed	
Number	Type
4	[C = O]

(2)

(b) Calculate the total energy changes involved in breaking and in forming all of these bonds. (Some have already been done for you.)

Total energy change in breaking bonds
[4 × 413] = 1652
[1 × 612] = 612
Total = kJ

Total energy change in forming bonds
4 × [805] = 3220
Total = kJ

(4)

(c) Describe, as fully as you can, what the figures in (b) tell you about the overall reaction.

_____

_____

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_____

_____

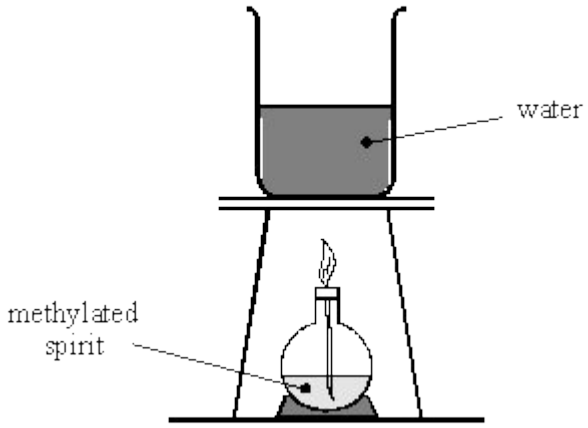
_____

(2)

(Total 8 marks)

Q27.

A student is using a spirit burner to heat some water.



(a) Complete these sentences.

Substances like methylated spirit which we burn to give out energy, are called

_____ . The energy is given out as _____ energy.

(2)

(b) Choose a word from this list to complete the sentence below.

gases **liquids** **solids**

The methylated spirit seems to disappear as it burns.

The new substances produced during burning are mainly _____.

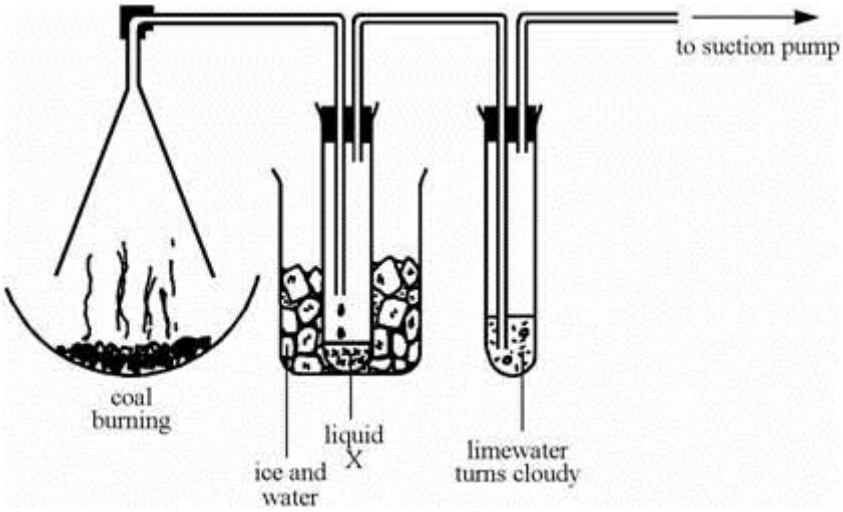
(1)

(Total 3 marks)

Q28.

The gases produced when coal burns are cooled by ice and then bubbled through limewater.

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(a) Complete these sentences.

(i) The coal is reacting with _____ when it burns.

(ii) During burning, elements in the coal are converted to compounds called _____.

(2)

(b) Choose words from this list to complete the sentences.

carbon **carbon dioxide** **sulphur** **sulphur dioxide**
sodium **water**

(i) Liquid X is a compound made from hydrogen and oxygen.

It is called _____

(ii) Sulphur dioxide is an acidic gas. It is given off when coal burns, because coal contains the element _____

(iii) Most fuels are compounds of hydrogen and _____

(3)

(c) Burning coal is an exothermic reaction.

Explain what "exothermic" means.

_____

_____

(1)

(d) (i) Which gas turns limewater cloudy?

_____

(ii) Which element in the coal is oxidised to form this gas?

_____

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(2)

(Total 8 marks)

Q29.

Choose words from this list to complete the sentences,

ammonia	**carbon dioxide**	**hydrogen**	**nitrogen**
electrical	**heat**	**solar**	**sound**

(a) In air, the two most common gases are oxygen and _____ .

(b) When natural gas burns, energy is released mainly as _____ .

(c) When natural gas burns, a gas is produced which turns limewater milky.

The gas is _____ .

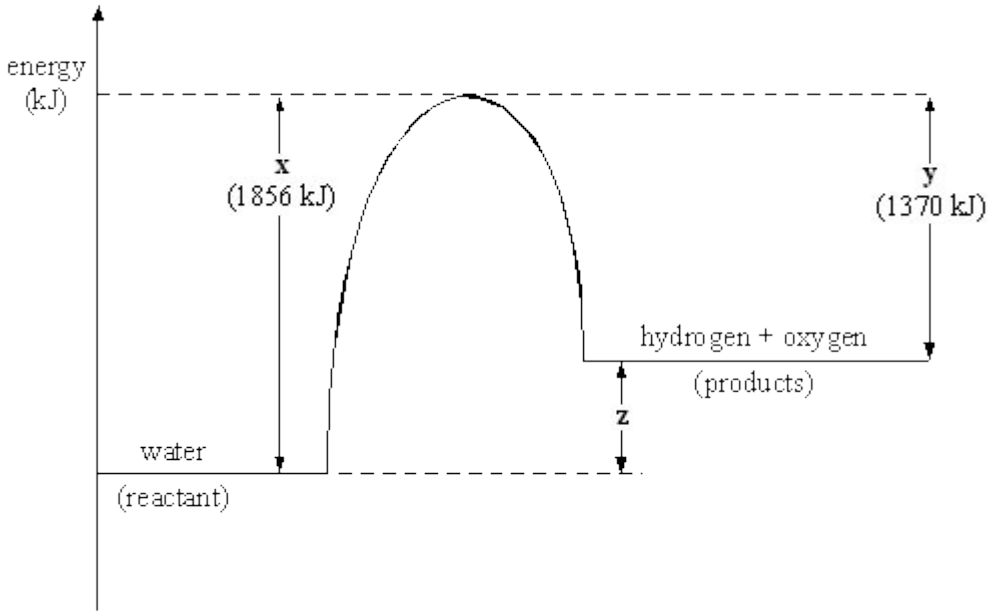
(Total 3 marks)

Q30.

The symbol equation shows the decomposition of water.

$2H_2O \rightarrow 2H_2 + O_2$

An energy level diagram for this reaction is shown below.



Explain the significance of **x**, **y** and **z** on the energy level diagram in terms of energy transfers that occur in the reaction. You should make specific reference to the bonds broken and formed and to the nett energy transfer (energy transferred to or from the surroundings).

_____

_____

_____

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_____

_____

_____

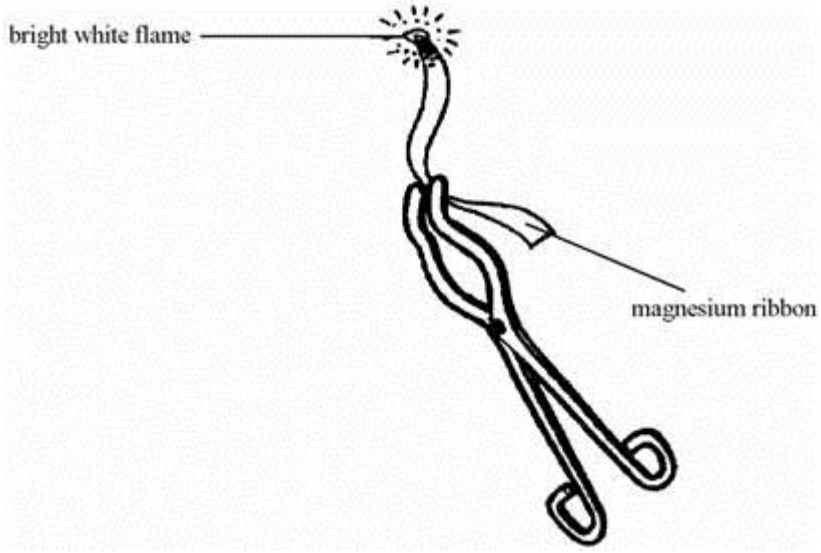
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_____

(Total 6 marks)

Q31.

The diagram shows some magnesium ribbon burning.



(a) Choose words from the list to complete the sentences below.

electrical **heat** **light** **kinetic**

an endothermic **an exothermic** **a neutralisation** **a reduction**

When magnesium burns, it transfers _____

and _____ energy to the surroundings.

We say that it is _____ reaction.

(3)

(b) Complete the word equation for the reaction.

magnesium + _____ ⟶ magnesium oxide

(1)

(Total 4 marks)

Q32.

Methane and oxygen react together to produce carbon dioxide and water.

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$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

818 kJ of energy is given out to the surroundings for each formula mass (mole) of methane that reacts.

The methane gas will not burn in oxygen until a flame is applied, but once lit it continues to burn.

(a) Explain why energy must be supplied to start the reaction but it continues by itself once started.

_____

_____

_____

_____

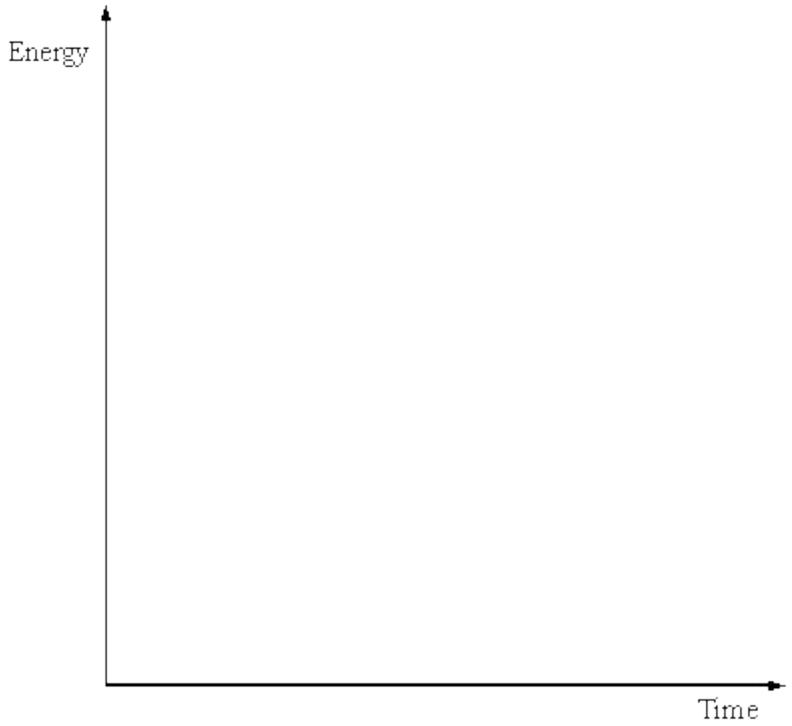
_____

_____

_____

(4)

(b) Sketch an energy level diagram for the reaction and indicate on the diagram the nett energy released.



(3)

(Total 7 marks)

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