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| Pearson Edexcel Level 1/Level 2 GCSE (9–1) | | | | | <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> | | | |
| <h1>Thursday 14 May 2020</h1> | | | | | | | | |
| Morning (Time: 1 hour 45 minutes) | | | | | Paper Reference 1CH0/1H | | | |
| <h2>Chemistry</h2> <h3>Paper 1</h3> <p style="text-align: right;">Higher Tier</p> | | | | | | | | |
| You must have: Calculator, ruler | | | | | | | Total Marks | |

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- Calculators may be used.
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

Information

- The total mark for this paper is 100.
- The marks for each question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*
- In questions marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically showing how the points that you make are related or follow on from each other where appropriate.
- There is a periodic table on the back cover of the paper.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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Pearson

Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross .
If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

- 1 Alloys of gold are often used to make jewellery.
The purity of gold is measured in carats.
Different alloys of gold have different carats.

(a) Figure 1 shows the percentage of different metals in two samples of gold.

| | percentage of metal | | |
|---------------|---------------------|--------|--------|
| | gold | silver | copper |
| 18 carat gold | 75.0 | 15.0 | 10.0 |
| 24 carat gold | 100.0 | 0.0 | 0.0 |

Figure 1

Explain why 18 carat gold is stronger than 24 carat gold.

You may use diagrams to help your answer.

(2)

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- (b) Figure 2 shows the relationship between the purity of gold in carats and the percentage of gold in the alloy.

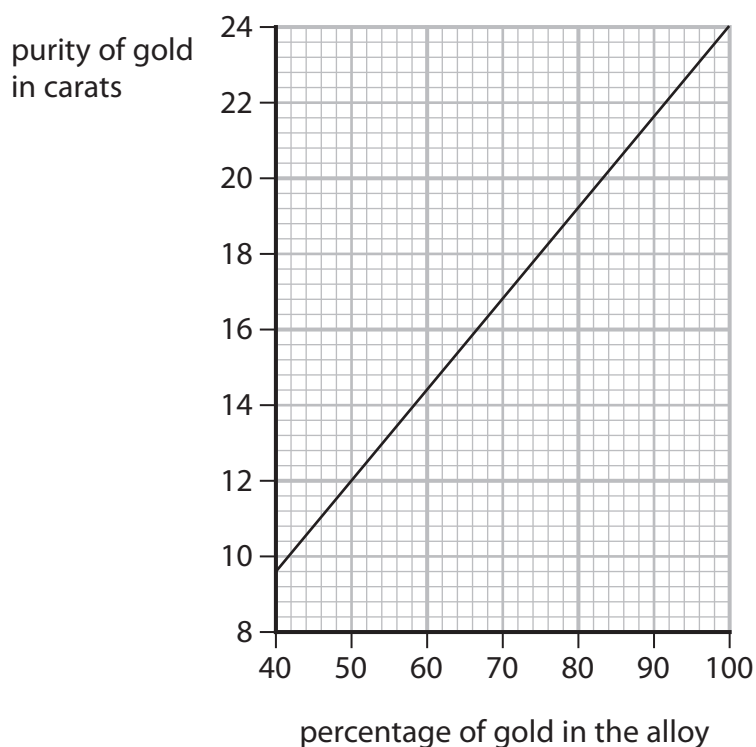


Figure 2

A necklace with a mass of 5.0g was found to contain 2.9g of gold.

Determine the purity of the gold necklace in carats.
Show your working.

(3)

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purity of the gold necklace = carats



(c) A gold ring contains 3.94 g of gold.

Calculate the number of gold atoms in the ring.

(relative atomic mass: Au = 197,
Avogadro constant = 6.02×10^{23})

Show your working.

(2)

number of gold atoms =

(Total for Question 1 = 7 marks)



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- 2 Figure 3 shows the apparatus that can be used to electrolyse sodium sulfate solution using inert electrodes.

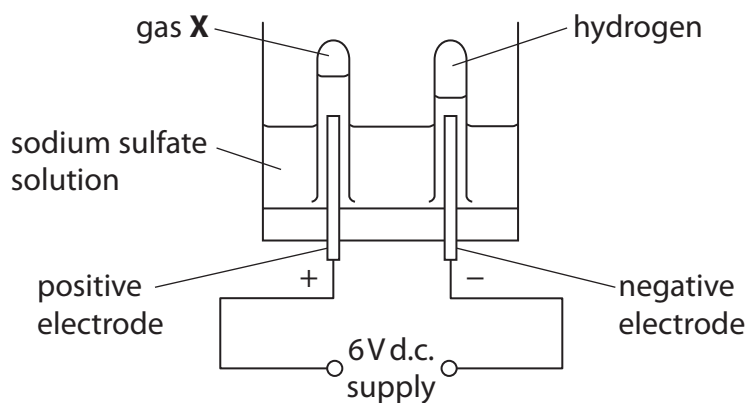


Figure 3

- (a) Hydrogen is produced at the negative electrode during electrolysis.

(i) Describe the test to show the gas is hydrogen.

(2)

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(ii) What is the name of gas **X** that forms at the positive electrode?

(1)

- A** ammonia
- B** oxygen
- C** nitrogen
- D** sulfur dioxide

(iii) State what is meant by the term **electrolysis**.

(2)

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(b) The sodium sulfate solution was made by dissolving 28.4 g of sodium sulfate in water to make 250 cm³ of solution.

Calculate the concentration of this solution in g dm⁻³.

Give your answer to three significant figures.

(3)

concentration = g dm⁻³

(c) The ions present in sodium sulfate are

| | |
|---------|-------------------------------|
| sodium | Na ⁺ |
| sulfate | SO ₄ ²⁻ |

Write the formula of sodium sulfate using this information.

(1)

(Total for Question 2 = 9 marks)

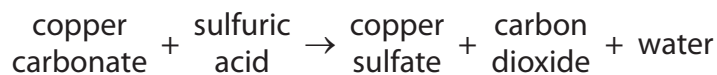
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3 The word equation for the reaction between copper carbonate and dilute sulfuric acid is



(a) (i) Complete the balanced equation for this reaction.

(2)



(ii) Calculate the relative formula mass of copper carbonate, CuCO_3 .
(relative atomic masses: C = 12.0, O = 16.0, Cu = 63.5)

(2)

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.....

.....

relative formula mass of CuCO_3 =

(iii) What is the chemical test to show that a gas is carbon dioxide?

(1)

- A bubble the gas through limewater, limewater turns cloudy
- B put damp blue litmus paper in the gas, litmus paper turns red
- C put a lighted splint into the gas, the splint is extinguished
- D measure the pH of the gas, pH = 4

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- (b) Figure 4 shows a conical flask containing dilute sulfuric acid. Copper carbonate is added to the acid in the flask. The copper carbonate is added one spatula measure at a time until the reaction has finished.

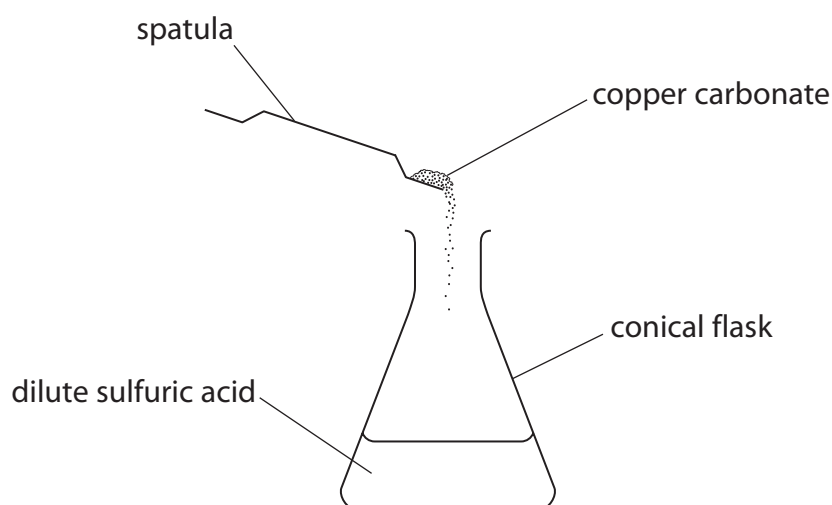


Figure 4

State **two** observations that would show the reaction has finished.

(2)

- 1
- 2

- (c) The electronic configuration of carbon is 2.4
The electronic configuration of oxygen is 2.6

Draw a dot and cross diagram for a molecule of carbon dioxide.

Show outer electrons only.

(2)

(Total for Question 3 = 9 marks)



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- 4 Potassium hydroxide reacts with hydrochloric acid to form potassium chloride and water.



- (a) A student carried out a titration to find the exact volume of dilute hydrochloric acid that reacted with 25.0 cm^3 of potassium hydroxide solution.

There were five steps in the titration.
The steps shown are not in the correct order.

step J pour the potassium hydroxide solution into a conical flask and add a few drops of indicator to this solution

step K fill a burette with the dilute hydrochloric acid and record the initial reading from the burette

step L use a measuring cylinder to obtain 25 cm^3 of potassium hydroxide solution

step M take a final reading from the burette and calculate the volume of the dilute hydrochloric acid reacted

step N run the dilute hydrochloric acid from the burette into the conical flask until the indicator changes colour

- (i) Write the steps in the correct order.

Some of the steps have been completed for you.

(1)

first step

last step

| | | | | |
|----------|--|--|--|----------|
| K | | | | M |
|----------|--|--|--|----------|

- (ii) Suggest an alternative piece of apparatus that could be used in step L to obtain exactly 25.0 cm^3 of potassium hydroxide solution.

(1)

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(b) A student was then asked to produce a pure sample of solid potassium chloride.

After finding the volume of acid reacted in step M, the student added this volume of acid to a fresh 25.0 cm^3 sample of the potassium hydroxide solution. This mixture was then evaporated.

(i) Explain why this new mixture was evaporated rather than the original mixture from the titration, to produce a pure sample of solid potassium chloride.

(2)

(ii) After evaporation, the mass of the potassium chloride was determined.

The theoretical yield of the experiment was 0.70 g.

The actual yield was 0.84 g.

This gave a percentage yield greater than 100%.

Calculate the percentage yield of this experiment.

(2)

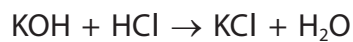
percentage yield =

(iii) Suggest a reason why the actual yield was greater than the theoretical yield.

(1)



- (iv) The equation for the reaction between potassium hydroxide solution and dilute hydrochloric acid is



Calculate the atom economy for the production of potassium chloride from potassium hydroxide and hydrochloric acid.

(relative formula masses: KOH = 56.0, HCl = 36.5, KCl = 74.5, H₂O = 18.0)

Give your answer to one decimal place.

(4)

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atom economy = %

(Total for Question 4 = 11 marks)

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- 5 (a) A sample of rock salt contains a mixture of sodium chloride and some insoluble substances.

The rock salt is added to water and the mixture stirred.

The mixture is then filtered to obtain a filtrate of sodium chloride solution.

- (i) Draw a labelled diagram of the apparatus used to filter the mixture and collect the sodium chloride solution.

(2)

- (ii) Describe how a sample of pure, dry sodium chloride crystals can be obtained from the filtrate.

(3)

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(b) Inks contain coloured dyes.
 Samples of four inks, **W**, **X**, **Y** and **Z**, were separated using paper chromatography.
 Figure 5 shows the chromatogram obtained.

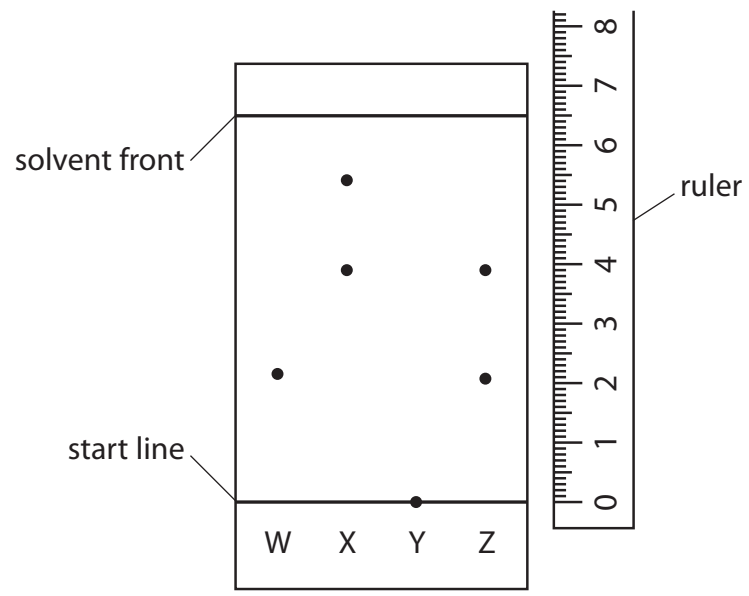


Figure 5

(i) In the experiment, the solvent front moved 6.5 cm.
 Calculate the R_f value of the dye that is present in both inks **X** and **Z**. (1)

$R_f =$

(ii) State what could be changed in the experiment to make the R_f value more accurate. (1)

(iii) In this experiment, ink sample **Y** did not move from the start line.
 Explain a change to the experiment that would be needed to separate the dyes in ink sample **Y**. (2)

(Total for Question 5 = 9 marks)

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6 Titanium and iron are examples of transition metals.

(a) Figure 6 shows the percentage abundance of each isotope in a sample of titanium.

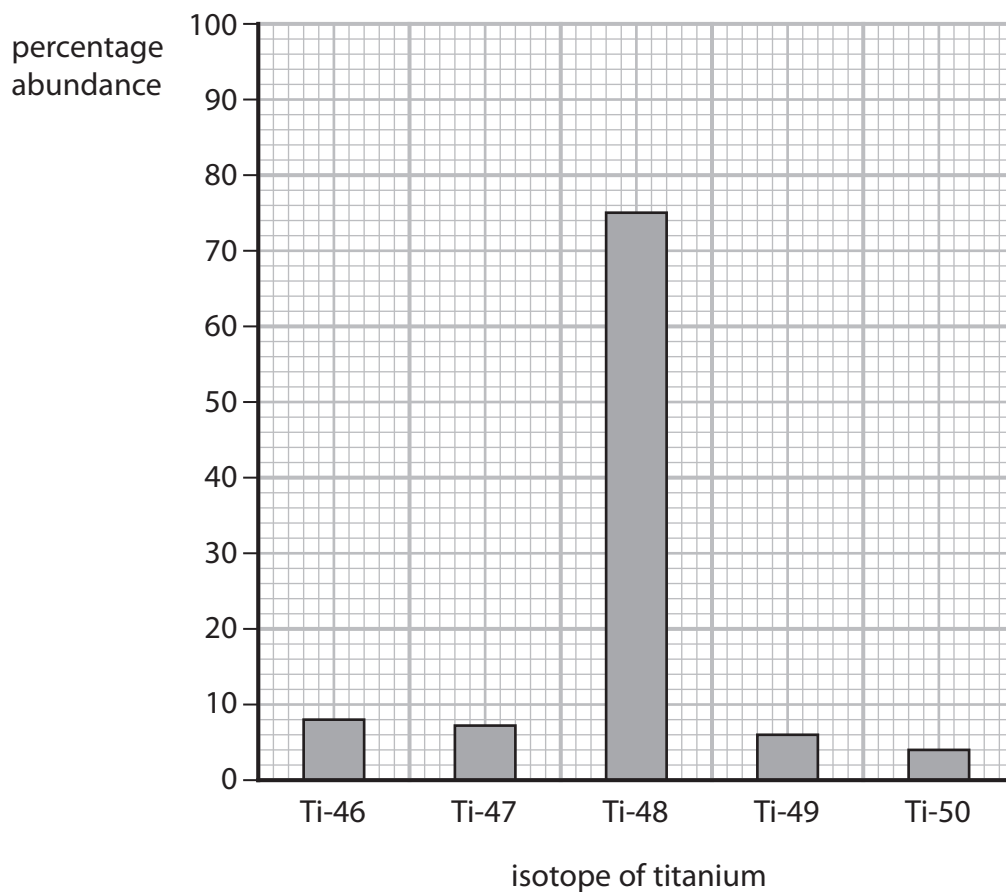


Figure 6

Calculate the relative atomic mass of titanium in this sample.

(3)

relative atomic mass =



(b) Iron, when heated in air, reacts with oxygen to form iron oxide.

(i) This reaction is an example of

(1)

- A crystallisation
- B distillation
- C neutralisation
- D oxidation

(ii) The equipment shown in Figure 7 can be used to find the mass of oxygen that combines with iron.

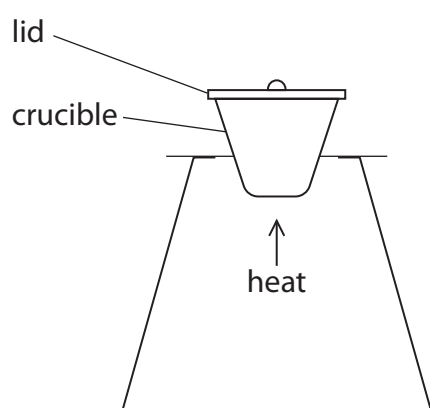


Figure 7

Describe how the equipment shown in Figure 7 could be used to find the mass of oxygen that combines with 0.500 g of iron wool in a crucible and lid of known mass.

(3)

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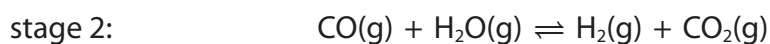
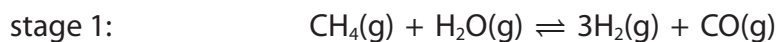
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- 7 (a) Methane reacts with steam to form hydrogen and carbon dioxide.

The reaction takes place in two stages.

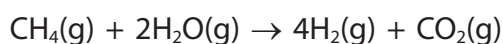


- (i) Stage 1 takes in heat energy, it is endothermic.

Explain the effect of increasing the temperature on the yield of the products of stage 1.

(2)

- (ii) The overall equation for the process is



0.40 g of methane were fully reacted with steam to form carbon dioxide and hydrogen.

Calculate the maximum volume of hydrogen in dm^3 , measured at room temperature and pressure, that could be made in this reaction.

(relative formula mass: $\text{CH}_4 = 16$,

1 mol of any gas at room temperature and pressure occupies 24 dm^3)

(3)

maximum volume of hydrogen = dm^3

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*(b) Hydrogen-oxygen fuel cells can be used to provide electrical energy in a spacecraft.

The reaction that takes place in the fuel cell is



Evaluate the advantages and disadvantages of providing electrical energy in a spacecraft using hydrogen-oxygen fuel cells rather than chemical cells.

(6)

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(Total for Question 7 = 11 marks)



- 8 (a) Calcium has an atomic number of 20.
A calcium atom has a mass number of 40.

(i) Which row of the table shows the number of protons and number of neutrons in this atom of calcium?

(1)

| | number of protons | number of neutrons |
|----------------------------|-------------------|--------------------|
| <input type="checkbox"/> A | 20 | 20 |
| <input type="checkbox"/> B | 40 | 20 |
| <input type="checkbox"/> C | 20 | 60 |
| <input type="checkbox"/> D | 60 | 20 |

(ii) Figure 8 shows the arrangement of electrons in an atom of calcium.

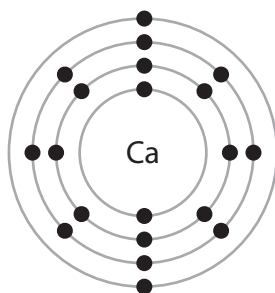


Figure 8

Explain, using the information in Figure 8, in which period of the periodic table calcium can be found.

(2)

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(b) Calcium and potassium react with water in similar ways.

- (i) One similarity in the reactions is that hydrogen gas is produced.

State **one** other similarity in the products of the reactions of calcium and potassium with water.

(1)

- (ii) Potassium is higher in the reactivity series than calcium and reacts more vigorously with water than calcium reacts with water.

State why potassium is higher in the reactivity series and reacts more vigorously with water than calcium.

(1)

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P 6 2 0 8 5 R A 0 2 5 3 2

*(c) Calcium chloride can be prepared by the reaction of calcium with chlorine gas.

Figure 9 shows some properties of calcium, chlorine and calcium chloride.

| substance | relative melting point | ability to conduct electricity | |
|------------------|------------------------|--------------------------------|-------------|
| | | when solid | when molten |
| calcium | high | good | good |
| chlorine | low | poor | poor |
| calcium chloride | high | poor | good |

Figure 9

Explain, in terms of bonding and structure, why the properties of the product, calcium chloride, are different from the properties of the reactants, calcium and chlorine.

(6)

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(Total for Question 8 = 11 marks)



9 (a) Dilute hydrochloric acid is a strong acid.

(i) Explain why dilute hydrochloric acid is described as a strong acid.

(2)

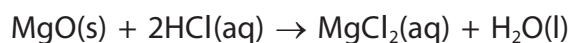
(ii) 1 cm^3 of hydrochloric acid of pH 2 is made up to a volume of 10 cm^3 with distilled water.

State the pH of the new solution.

(1)

pH =

(b) Magnesium oxide reacts with dilute hydrochloric acid to produce magnesium chloride solution and water.



Write the ionic equation for this reaction.

(3)

(c) In an experiment magnesium hydroxide powder is added in 0.1 g portions to 25 cm^3 of dilute hydrochloric acid until the magnesium hydroxide is just in excess.

Universal indicator paper can be used to test the pH of the solution after each addition of magnesium hydroxide.

(i) Give the name of an alternative piece of equipment that can be used to measure pH.

(1)

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(ii) State and explain how the pH changes as the magnesium hydroxide is added to the dilute hydrochloric acid.

(4)

(Total for Question 9 = 11 marks)

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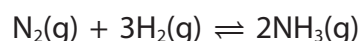
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10 (a) Ammonia is manufactured by the Haber process.

The equation for the reaction is



The reaction is reversible and can reach equilibrium.

(i) An iron catalyst can be used in the reaction.

Which row of the table shows how adding the iron catalyst affects the rate of attainment of equilibrium and the equilibrium yield of ammonia?

(1)

| | rate of attainment of equilibrium | equilibrium yield of ammonia |
|----------------------------|-----------------------------------|------------------------------|
| <input type="checkbox"/> A | increases | increases |
| <input type="checkbox"/> B | decreases | does not change |
| <input type="checkbox"/> C | decreases | increases |
| <input type="checkbox"/> D | increases | does not change |

(ii) Which of the following statements is correct when the reaction reaches equilibrium?

(1)

- A the reverse reaction starts to take place
- B the amounts of nitrogen, hydrogen and ammonia are equal
- C the amounts of nitrogen, hydrogen and ammonia become constant
- D the reaction stops

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(iii) The reaction is carried out at a pressure of 200 atmospheres.

Explain what effect a pressure higher than 200 atmospheres would have on the rate of attainment of equilibrium and on the equilibrium yield of ammonia.

(4)

(b) Ammonium sulfate and ammonium nitrate are used as fertilisers as they both contain nitrogen, which will increase the yield of crops.

(i) Suggest **one** other reason for using solid ammonium sulfate and solid ammonium nitrate as nitrogenous fertilisers.

(1)

(ii) Ammonium nitrate can be made by the reaction of ammonia with nitric acid.

Write the balanced equation for this reaction.

(2)

(iii) Describe **one** similarity and **one** difference between the industrial production of ammonium sulfate and the laboratory preparation of ammonium sulfate.

(2)

similarity.....

difference.....

(Total for Question 10 = 11 marks)

TOTAL FOR PAPER = 100 MARKS



