

Write your name here

Surname

Model Answers

Other names

**Pearson Edexcel
International GCSE**

Centre Number

--	--	--	--	--

Candidate Number

--	--	--	--	--

Chemistry

Unit: 4CH0

Paper: 2CR

Wednesday 14 June 2017 – Morning

Time: 1 hour

Paper Reference

4CH0/2CR

You must have:

Ruler, calculator

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.*
- Show all the steps in any calculations and state the units.
- Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

P48443A

©2017 Pearson Education Ltd.

1/1/1/1/1/



P 4 8 4 4 3 A 0 1 2 0



Pearson

2

P 4 8 4 4 3 A 0 2 2 0

Relative atomic mass	Symbol	Name	Atomic number

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

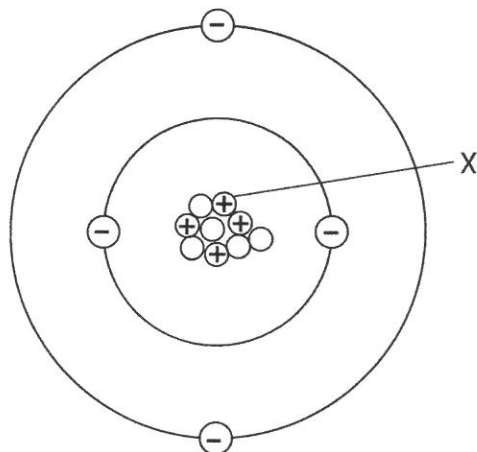
BLANK PAGE



P 4 8 4 4 3 A 0 3 2 0

Answer ALL questions.

1 The diagram represents an atom of an element.



(a) (i) What is the particle labelled X?

- ☐ A an electron
☐ B an ion
☒ C a proton
☐ D a neutron

(1)

1.09

(ii) What is the mass number of this atom?

- ☐ A 4
☐ B 5
☒ C 9
☐ D 13

(1)

1.11

(iii) Name the element that contains these atoms.

(1)

Beryllium

DO NOT WRITE IN THIS AREA



(b) Hydrogen has three isotopes.

State, in terms of subatomic particles, one way in which these isotopes are the same and one way in which they are different.

(2)

same *number of protons*

different *number of neutrons*

(Total for Question 1 = 5 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



P 4 8 4 4 3 A 0 5 2 0

2 A small piece of magnesium ribbon is added to dilute sulfuric acid in a test tube.

Hydrogen gas is produced.

(a) State two observations that are seen during the reaction.

(2)

1 Bubbles

2 Magnesium disappears

(b) The reaction is exothermic.

State what happens to the temperature of the acid during the reaction.

(1)

Increases

(c) Write a word equation for the reaction.

(1)

magnesium + sulfuric acid → magnesium sulfate + hydrogen

(Total for Question 2 = 4 marks)

DO NOT WRITE IN THIS AREA

2.25

2.25

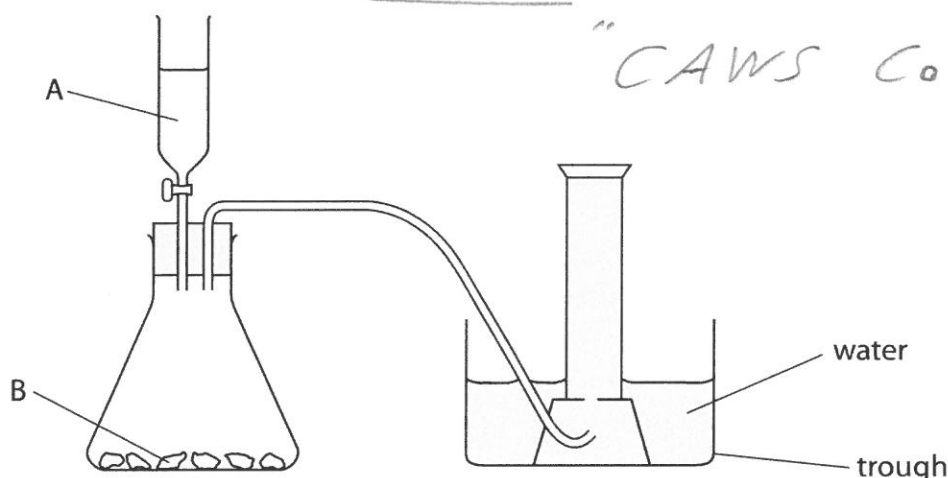
1.21

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



3 This apparatus can be used to prepare carbon dioxide from reagents A and B.



(a) Calcium chloride and water are also products of the reaction between A and B.

Identify reagent A and reagent B.

A hydrochloric acid
B calcium carbonate

(b) In the diagram, the carbon dioxide is collected over water.

State another way of collecting the carbon dioxide.

Gas syringe

(c) At the end of the experiment, the solution in the trough is weakly acidic.

(i) State the colour of the solution when some Universal Indicator is added.

Orange

(ii) Give the name and the formula of the acid that forms when carbon dioxide dissolves in water.

name carbonic acid
formula H_2CO_3

(Total for Question 3 = 6 marks)



P 4 8 4 4 3 A 0 7 2 0

4 Crude oil is a complex mixture containing many compounds and is a source of many chemicals.

(a) Most of the compounds in crude oil contain two elements.

Name these two elements.

hydrogen and carbon

(1)

(b) Crude oil is separated into fractions in order to produce useful chemicals.

(i) State what is meant by the term **fraction**.

Compounds with similar boiling points

(1)

(ii) Describe the industrial process used to obtain fractions from crude oil.

• Crude oil heated / vapourised

(3)

• Passed into fractional distillation tower

(• Tower is hotter at bottom)

• Gases cool as they rise and fractions condense when they reach height of appropriate temperature

DO NOT WRITE IN THIS AREA

3:01
5:06

5:07

5:07

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



(c) The box shows four fractions obtained from crude oil.

bitumen	diesel	fuel oil	gasoline
---------	--------	----------	----------

- 1) ref. gas
- 2) Gasoline
- 3) Kerosene
- 4) Diesel
- 5) Fuel oil
- 6) Bitumen

(i) Which of these fractions contains compounds with the highest boiling points?

(1)

Bitumen

5.09

(ii) Which of these fractions is the most volatile?

Means "evaporates most easily"

(1)

Gasoline

5.09

(d) Fuel oil can be burned to heat homes.

If combustion is incomplete, a dangerous gas is produced.

(i) Name this gas.

(1)

carbon monoxide

5.10

(ii) State why this gas is dangerous.

(1)

• CO is poisonous

• It inhibits the blood from carrying oxygen around the body.

5.10

(Total for Question 4 = 9 marks)

either one scores 1 mark

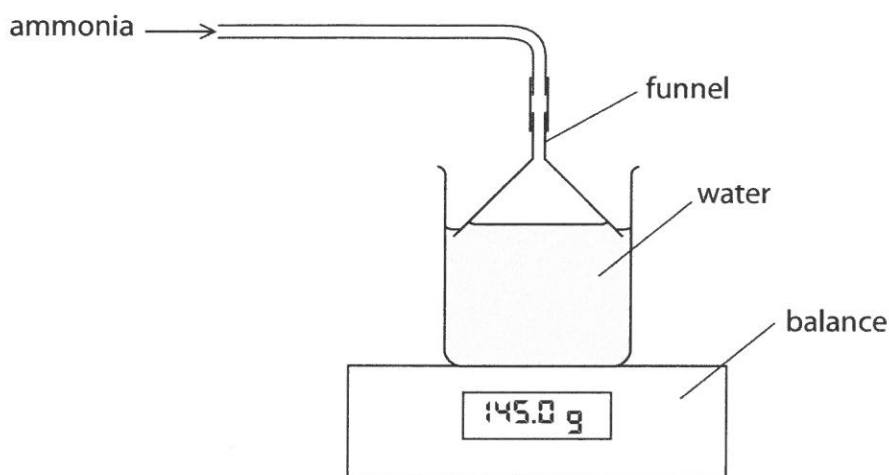


P 4 8 4 4 3 A 0 9 2 0

For part (6)

5 Ammonia is a toxic gas that is very soluble in water.

A teacher uses this apparatus to investigate the solubility of ammonia in water at different temperatures.



This is the teacher's method.

- pour 100 cm³ of water into the beaker and measure the temperature of the water
- place the beaker on the balance and record the mass of the beaker and water
- bubble ammonia into the water until the mass is constant
- record the constant mass

The teacher repeats the experiment with the water at different temperatures.

The table shows the teacher's results.

Temperature of water in °C	Mass at start in g	Mass at end in g
15	145.0	204.5
20	145.0	198.1
25	145.0	191.6
30	145.0	185.1

Mass of water + beaker + ammonia

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



(a) (i) Calculate the mass of ammonia dissolved in 100 cm³ of water at 25 °C.

(1)

$$191.6 - 145.0 =$$

mass of ammonia = 46.6 g

(ii) State the relationship between temperature and solubility of ammonia.

(1)

As temperature increases
the solubility of ammonia decreases

(b) Explain one safety precaution that the teacher should take when doing this experiment.

(2)

• Use a fume cupboard

• because ammonia is a toxic gas

(c) When the teacher does the experiment at a higher temperature, the reading on the balance gradually increases but then slowly decreases.

Suggest why the reading on the balance slowly decreases.

(1)

Water evaporates

(d) Ammonia is an alkaline gas.

Suggest a different method that the teacher could use to compare the mass of ammonia dissolved in the water at different temperatures.

(1)

Titrate with acid

(Total for Question 5 = 6 marks)



6 Ethanol can be made by two different methods.

- method 1 fermentation of glucose
method 2 reaction of ethene with steam

(a) Name the catalyst used in each method.

method 1

zymase (yeast)

method 2

phosphoric acid

(2)

← 3:10

← 3:09

(b) Two companies produce ethanol for different purposes.

The table gives some information about each company.

	Company A	Company B
Location of company	large agricultural area	near an oil refinery
Use of ethanol	to obtain a dilute solution to convert into vinegar	as a solvent for perfumes

Explain which method of production each company is more likely to use.

(4)

Company A

- Fermentation (method 1)
- Access to land to grow sugar
- Ethanol does not need to be pure

3:11

Company B

- Method 2
- Access to ethene from oil refinery
- Ethanol needs to be pure.

DO NOT WRITE IN THIS AREA

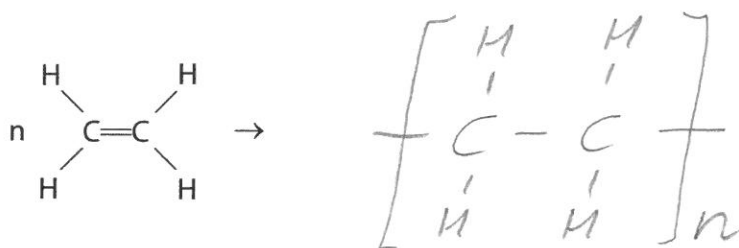


(c) Most of the ethene used to make polymers is produced by the cracking of crude oil fractions.

(i) One of the polymers made from ethene is poly(ethene).

Complete the equation to show the formation of poly(ethene) from ethene.

(2)

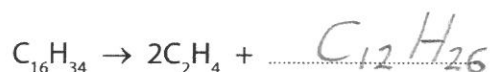


5.16

(ii) The kerosene fraction obtained from crude oil contains a hydrocarbon with the formula $\text{C}_{16}\text{H}_{34}$

Complete the equation to show the formation of ethene and one molecule of another hydrocarbon from the cracking of $\text{C}_{16}\text{H}_{34}$

(1)



5.13

(iii) Suggest why it may be necessary, in future, to make ethene from ethanol.

(1)

Crude oil is a resource with limited supply.

3.11

(Total for Question 6 = 10 marks)



P 4 8 4 4 3 A 0 1 3 2 0

DO NOT WRITE IN THIS AREA

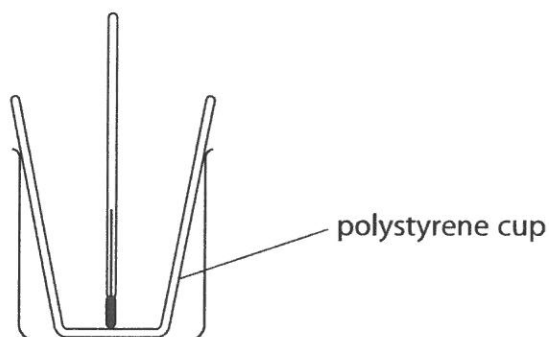
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE



- 7 A student uses this apparatus to investigate the change in temperature when dilute hydrochloric acid is added to aqueous sodium hydroxide.



This is the student's method.

- pour some aqueous sodium hydroxide into the polystyrene cup
- record the temperature of the sodium hydroxide
- add some dilute hydrochloric acid and stir the mixture
- record the highest temperature of the mixture

The student repeats the experiment using different volumes of the two solutions.

- (a) Explain why the student uses a polystyrene cup to contain the solution, rather than a beaker.

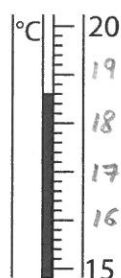
(2)

• Polystyrene is a better thermal insulator than a beaker

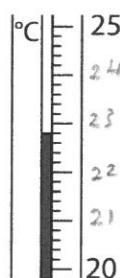
4.11

• so less heat is lost to surroundings

- (b) The diagram shows the thermometer readings for one experiment before and after adding the acid.



before



after

4.11

Record the temperatures before and after adding the acid.

(2)

before 18.6 °C

after 22.8 °C

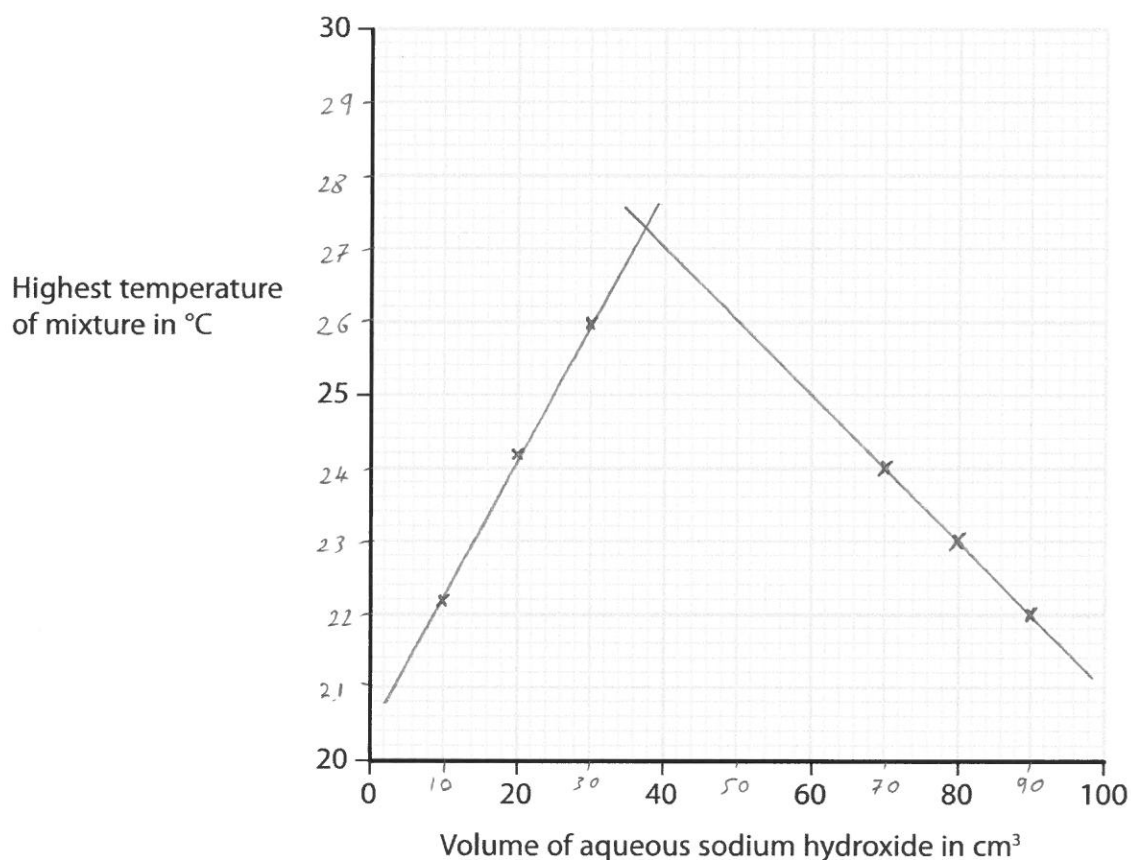


(c) The table shows the results of a series of experiments.

The initial temperatures of the aqueous sodium hydroxide and the dilute hydrochloric acid are the same.

Experiment	Volume of aqueous sodium hydroxide in cm ³	Volume of dilute hydrochloric acid in cm ³	Highest temperature of mixture in °C
1	10	90	22.2
2	20	80	24.2
3	30	70	26.0
4	70	30	24.0
5	80	20	23.0
6	90	10	22.0

(i) Plot the results from the table on the grid.



Draw a straight line of best fit for experiments 1, 2 and 3.

Draw a second straight line of best fit for experiments 4, 5 and 6.

Extend both lines so that they cross.

(4)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

4.11



- (ii) The point where the two lines cross indicates when equal amounts, in moles, of sodium hydroxide and hydrochloric acid react.

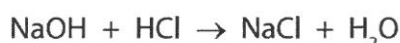
Use your graph to find the volumes that contain equal amounts of sodium hydroxide and hydrochloric acid.

$$100 - 38 =$$

volume of sodium hydroxide 38 cm³

volume of hydrochloric acid 62 cm³

- (iii) The equation for the reaction between sodium hydroxide and hydrochloric acid is



Explain which solution, the sodium hydroxide or the hydrochloric acid, has the greater concentration.

- The sodium hydroxide has a greater concentration
- Less volume of NaOH required to react fully than HCl
- Ratio of NaOH : HCl in equation is 1:1

(Total for Question 7 = 12 marks)



8 A student does a titration to find the concentration of a solution of nitric acid.

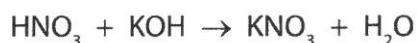
This is the student's method.

- pipette ^{0.025 dm³} 25.0 cm³ of the nitric acid into a conical flask ← acid
- add a few drops of indicator
- add aqueous potassium hydroxide from a burette until the indicator just changes colour
- determine the volume of alkali added from the burette

The concentration of the potassium hydroxide solution is 0.0200 mol/dm³. ← alkali

The volume of potassium hydroxide required to neutralise the acid is ~~23.50 cm³~~. 0.0235 dm³

The equation for the reaction between nitric acid and potassium hydroxide is



← ratio 1:1

(a) (i) Calculate the amount, in moles, of KOH used in this titration.

← alkali

$$n(\text{KOH}) = C \times V$$
$$= 0.02 \times 0.0235 =$$

amount of KOH = 0.000470 mol

(ii) Calculate the concentration, in mol/dm³, of the nitric acid.

ratio 1:1, so $n(\text{HNO}_3) = n(\text{KOH})$ (2)

$$= 0.00047$$

$$C(\text{HNO}_3) = \frac{n}{V}$$
$$= \frac{0.00047}{0.025} =$$

concentration of nitric acid = 0.0188 mol/dm³

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

1.27

DO NOT WRITE IN THIS AREA



- (b) The student makes a solution of potassium nitrate by neutralising aqueous potassium hydroxide with dilute nitric acid.

Describe how he could use crystallisation to obtain a pure, dry sample of potassium nitrate crystals from the solution of potassium nitrate.

(4) so don't need to describe titration

- Gently heat the potassium nitrate solution until crystals start to form
- Leave the solution to cool until crystals have formed
- Filter to remove the crystals and wash with distilled water
- Put crystals in a warm place to dry

1.07
4.07

(Total for Question 8 = 8 marks)

TOTAL FOR PAPER = 60 MARKS



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE

Every effort has been made to contact copyright holders to obtain their permission for the use of copyright material. Pearson Education Ltd. will, if notified, be happy to rectify any errors or omissions and include any such rectifications in future editions.

