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|---------------------------------------------------------------------------------------------------------------------------------------|--|------------------|--|
| Write your name here                                                                                                                  |  |                  |  |
| Surname                                                                                                                               |  | Other names      |  |
| <b>Pearson Edexcel Certificate</b>                                                                                                    |  | Centre Number    |  |
| <b>Pearson Edexcel International GCSE</b>                                                                                             |  | Candidate Number |  |
|                                                                                                                                       |  |                  |  |
| <h1 style="margin: 0;">Chemistry</h1> <h2 style="margin: 5px 0 0 0;">Unit: KCH0/4CH0</h2> <h2 style="margin: 0 0 0 0;">Paper: 2C</h2> |  |                  |  |
| Friday 16 January 2015 – Morning                                                                                                      |  | Paper Reference  |  |
| <b>Time: 1 hour</b>                                                                                                                   |  | <b>KCH0/2C</b>   |  |
| <b>You must have:</b>                                                                                                                 |  | Total Marks      |  |
| Calculator                                                                                                                            |  |                  |  |

### 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.
- Keep an eye on the time.
- 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* ►

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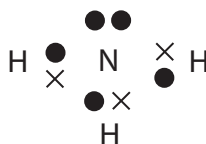
## 2

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## Key

**Answer ALL questions.**

**1** The diagram represents a particle of ammonia.



(a) This particle of ammonia is

(1)

- ☐ **A** an atom
- ☐ **B** an ion
- ☐ **C** a lattice
- ☐ **D** a molecule

(b) Which type of bonding is present in this particle of ammonia?

(1)

- ☐ **A** covalent
- ☐ **B** hydrogen
- ☐ **C** ionic
- ☐ **D** metallic

(c) What is the formula of ammonia?

(1)

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**(Total for Question 1 = 3 marks)**

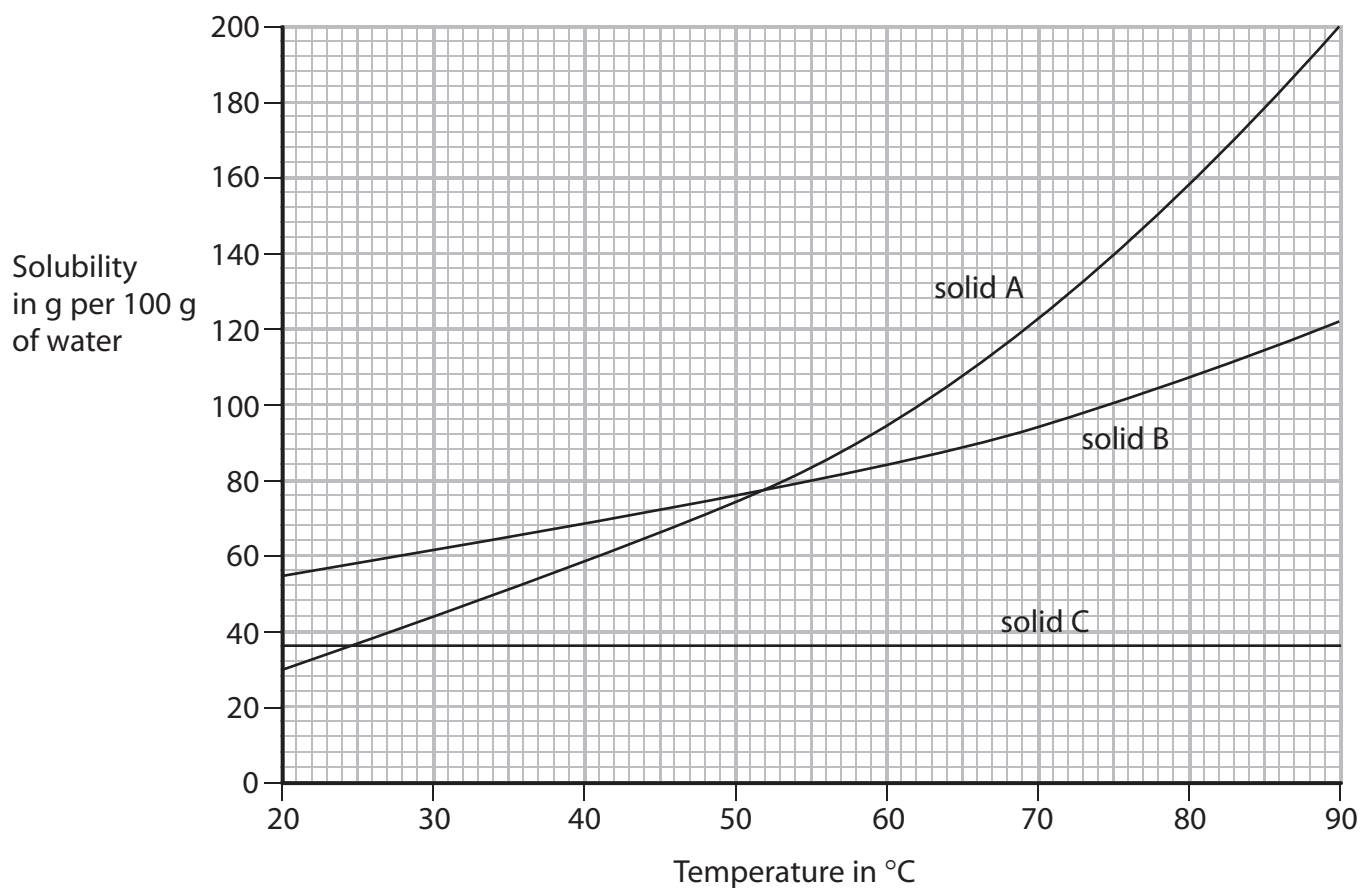
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- 2 The solubility of a solid in water is the maximum mass of the solid that can dissolve in 100 g of water at a given temperature.

An aqueous solution containing this maximum mass can be described as a saturated solution.

The graph shows the solubilities of three solids at different temperatures.



- (a) (i) What is the relationship between solubility and temperature for solid A?

(1)

- (ii) Which solid is the most soluble at 30°C?

(1)



(b) Explain what you would observe if a saturated solution of solid A were cooled from 90°C to 20°C.

(2)

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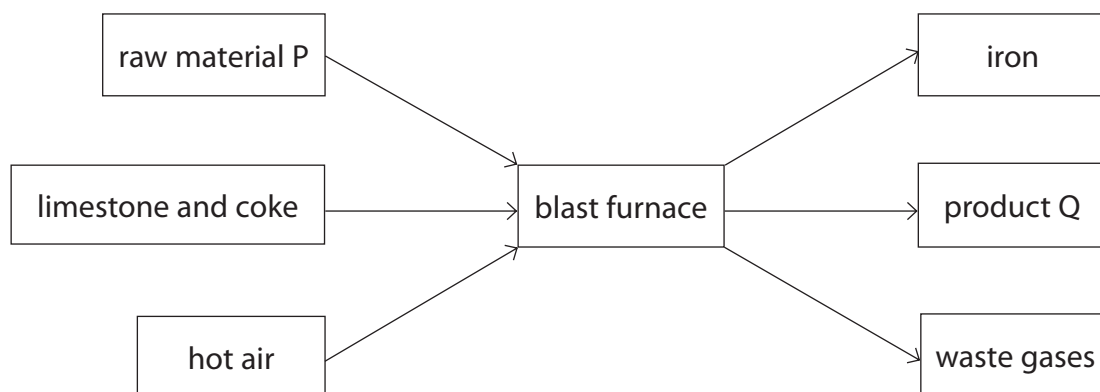
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**(Total for Question 2 = 4 marks)**



3 The diagram shows how iron is produced in a blast furnace.



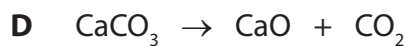
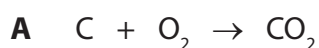
(a) Give the name of raw material P and of product Q.

(2)

raw material P .....

product Q .....

(b) The equations for some reactions in a blast furnace are



The table shows some types of reaction that occur in a blast furnace.

Complete the table by writing a letter, A, B, C, D, or E, to link each type of reaction to an appropriate reaction equation.

Each letter may be used once, more than once or not at all.

The first one has been done for you.

(3)

| Type of reaction                    | Letter |
|-------------------------------------|--------|
| one that gives out heat             | A      |
| one that is a thermal decomposition |        |
| one that is a neutralisation        |        |
| one that forms a poisonous gas      |        |



(c) The rusting of iron objects is a major problem.

Name the two substances needed for iron to rust.

(2)

1 .....

2 .....

(d) The order of reactivity of three metals is

**most reactive**

zinc

iron

tin

**least reactive**

Iron objects can be prevented from rusting by coating them with zinc or tin.

Some of these objects may be scratched when used, so the coating may come off.

Use the order of reactivity of the metals to suggest why coating these objects with zinc is more effective than coating them with tin.

(3)

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**(Total for Question 3 = 10 marks)**



P 4 4 2 5 5 A 0 7 2 0

**4** (a) Wine can be made from grapes.

The grapes are crushed to produce an aqueous solution containing glucose.  
Yeast is then added to this solution.

The solution is kept at a constant temperature for a period of time. The glucose is converted into ethanol.

(i) Name the process in which glucose is converted into ethanol.

(1)

(ii) What is the purpose of the yeast?

(1)

(b) Grape vines can be attacked by a fungus that ruins the grapes. The fungus can be killed using Bordeaux mixture, a solid containing copper(II) sulfate and calcium hydroxide.

(i) State a test to show that Bordeaux mixture contains calcium ions.

(2)

test for calcium ions .....

observation .....

(ii) A sample of Bordeaux mixture is dissolved in water.

Describe separate tests to show that this solution contains copper(II) ions and sulfate ions.

(5)

test for copper(II) ions .....

observation .....

test for sulfate ions .....

observation .....



- (c) Ethanol can be manufactured by passing a hot mixture of ethene and steam, at a high pressure, over a catalyst.

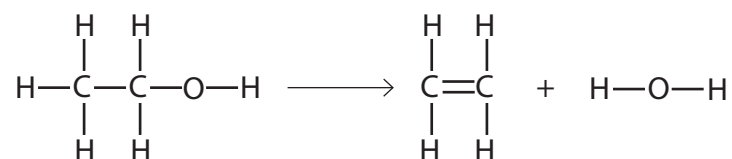
State the pressure used and name the catalyst.

(2)

pressure ..... atm

catalyst .....

- (d) The equation for the conversion of ethanol into ethene can be written using displayed formulae.



The table gives some average bond energies.

| Bond | Average bond energy<br>in kJ/mol |
|------|----------------------------------|
| C—C  | 348                              |
| C=C  | 612                              |
| C—H  | 412                              |
| C—O  | 360                              |
| O—H  | 463                              |

Use information from the table to calculate the enthalpy change, in kJ/mol, for the conversion of ethanol into ethene.

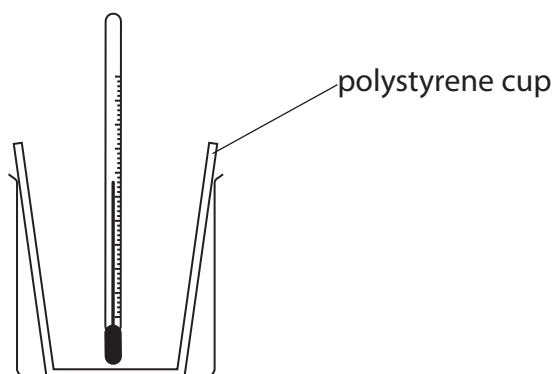
(4)

enthalpy change = ..... kJ/mol

(Total for Question 4 = 15 marks)

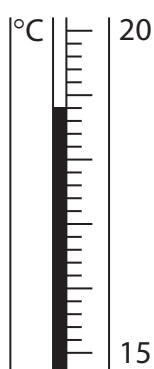


- 5 A student uses this apparatus to investigate the temperature change that occurs when potassium hydroxide is dissolved in water.

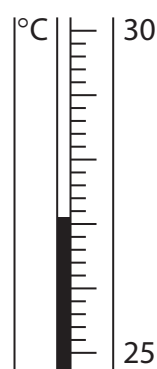


She uses this method.

- pour  $50\text{ cm}^3$  of water into the polystyrene cup and measure the temperature of the water
  - add 3 g of potassium hydroxide and stir
  - record the highest temperature of the solution
- (a) These diagrams show the thermometer readings before and after the student added the potassium hydroxide.



before



after

Use the readings to complete the table.

(3)

|                                                     |  |
|-----------------------------------------------------|--|
| temperature in °C after adding potassium hydroxide  |  |
| temperature in °C before adding potassium hydroxide |  |
| temperature change in °C                            |  |



(b) The student uses her results to calculate the enthalpy change for dissolving potassium hydroxide in water.

She compares her value with a data book value.

Student's value =  $-32 \text{ kJ/mol}$ .

Data book value =  $-55 \text{ kJ/mol}$ .

There are no errors in the student's method or in the calculation.

Suggest two reasons why the student's value differs from the data book value.

(2)

1 .....

.....

.....

2 .....

.....

.....

**(Total for Question 5 = 5 marks)**



**6** Potassium sulfide is an ionic compound.

- (a) Complete the table to show the arrangement of electrons in the ions formed when potassium and sulfur react to form potassium sulfide.

Give the charge on each of the ions.

(3)

| Element | Arrangement of electrons in atom | Arrangement of electrons in ion | Charge on ion |
|---------|----------------------------------|---------------------------------|---------------|
| K       | 2.8.8.1                          |                                 |               |
| S       | 2.8.6                            |                                 |               |

- (b) (i) Explain why potassium sulfide conducts electricity when molten.

(1)

.....

.....

- (ii) Explain why potassium sulfide has a high melting point.

(3)

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**(Total for Question 6 = 7 marks)**

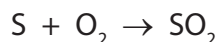


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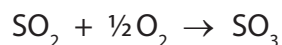


**7** Sulfuric acid can be manufactured from sulfur in a four-stage process.

stage 1 sulfur is burned in air to form sulfur dioxide



stage 2 the sulfur dioxide is reacted with more oxygen to form sulfur trioxide



stage 3 the sulfur trioxide is absorbed in concentrated sulfuric acid to make oleum



stage 4 the oleum is carefully diluted with water to form sulfuric acid

(a) Write a chemical equation for the formation of sulfuric acid from oleum.

(1)

(b) A mass of 80 tonnes of sulfur is reacted with oxygen in stage 1.

Calculate the maximum mass, in tonnes, of sulfur trioxide that can be produced in stage 2.

[1 tonne =  $1.0 \times 10^6$  g]

(3)

maximum mass = .....tonnes



- (c) Calculate the minimum volume at rtp, in cubic decimetres ( $\text{dm}^3$ ), of oxygen required to completely react with 64 tonnes of sulfur dioxide.

[1 mol of oxygen at rtp has a volume of  $24 \text{ dm}^3$ ]

(2)

volume of oxygen = ..... $\text{dm}^3$

**(Total for Question 7 = 6 marks)**

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**8** A student is supplied with aqueous solutions of these substances.

- bromine
- chlorine
- iodine
- potassium bromide
- potassium chloride
- potassium iodide

Describe two experiments the student could perform, using some of the solutions, to show the order of reactivity of bromine, chlorine and iodine.

Your answer should include the observations that the student would expect to make, and a chemical equation for one of the reactions.

(5)

[illegible]

**(Total for Question 8 = 5 marks)**



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9 Nitrogen dioxide ( $\text{NO}_2$ ) is a brown gas.

Dinitrogen tetraoxide ( $\text{N}_2\text{O}_4$ ) is a colourless gas.

The two gases can exist together in dynamic equilibrium according to the equation



A mixture of nitrogen dioxide gas and dinitrogen tetraoxide gas is allowed to reach equilibrium in a sealed container at  $20^\circ\text{C}$ . This equilibrium mixture is brown in colour.

(a) The sealed container is immersed in hot water at  $60^\circ\text{C}$ .

As the temperature of the gas mixture increases, the pressure of the gas mixture also increases.

(i) Predict the effect of the increase in temperature on the position of equilibrium.

(1)

(ii) Predict the effect of the increase in pressure on the position of equilibrium.

(1)

(iii) Suggest why it is difficult to predict which way the equilibrium will shift.

(1)



(b) Suggest why the equilibrium mixture is a darker shade of brown at 60°C than the equilibrium mixture at 20°C.

(2)

.....

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**(Total for Question 9 = 5 marks)**

**TOTAL FOR PAPER = 60 MARKS**



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