

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

Group	1	2
0	0	0
7	0	0
6	0	0
5	0	0
4	0	0
3	0	0

Period

$ \begin{array}{c} 1 \\ \text{H} \\ \text{Hydrogen} \end{array} $	$ \begin{array}{c} 4 \\ \text{He} \\ \text{Helium} \\ 2 \end{array} $
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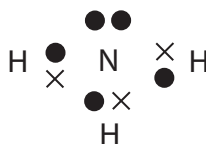
7	9											11	12	14	16	19	20
Li Lithium 3	Be Beryllium 4											B Boron 5	C Carbon 6	N Nitrogen 7	O Oxygen 8	F Fluorine 9	Ne Neon 10
23	24											27	28	31	32	35.5	40
Na Sodium 11	Mg Magnesium 12											Al Aluminium 13	Si Silicon 14	P Phosphorus 15	S Sulfur 16	Cl Chlorine 17	Ar Argon 18
39	40											70	73	75	79	80	84
K Potassium 19	Ca Calcium 20											Ga Gallium 31	Ge Germanium 32	As Arsenic 33	Se Selenium 34	Br Bromine 35	Kr Krypton 36
86	88											115	119	122	128	127	131
Rb Rubidium 37	Sr Strontium 38											In Indium 49	Sn Tin 50	Sb Antimony 51	Te Tellurium 52	I Iodine 53	Xe Xenon 54
133	137											204	207	209	210	210	222
Cs Caesium 55	Ba Barium 56											Tl Thallium 81	Pb Lead 82	Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
223	226											201	201	201	201	201	222
Fr Francium 87	Ra Radium 88											Hg Mercury 80	Pt Platinum 78	Au Gold 79	Ir Iridium 77	Os Osmium 76	Rn Radon 86
227	227											59	59	59	59	59	86
Ac Actinium 89	Ra Radium 88											Co Cobalt 27	Ni Nickel 28	Cu Copper 29	Zn Zinc 30	Ge Germanium 32	Kr Krypton 36
89	88											56	56	56	56	56	84
Sc Scandium 21	Ca Calcium 20											Fe Iron 26	Co Cobalt 27	Ni Nickel 28	Cu Copper 29	Zn Zinc 30	Kr Krypton 36
45	48											55	56	59	63.5	65	84
Sc Scandium 21	Ti Titanium 22											Mn Manganese 25	Fe Iron 26	Co Cobalt 27	Ni Nickel 28	Cu Copper 29	Kr Krypton 36
89	91											99	101	103	108	112	131
Y Yttrium 39	Zr Zirconium 40											Tc Technetium 43	Ru Ruthenium 44	Rh Rhodium 45	Ag Silver 47	Cd Cadmium 48	Xe Xenon 54
139	179											186	190	192	197	201	222
La Lanthanum 57	Hf Hafnium 72											Re Rhenium 75	Os Osmium 76	Ir Iridium 77	Pt Platinum 78	Au Gold 79	Rn Radon 86
227	226											73	74	77	78	80	86
Fr Francium 87	Ra Radium 88											Ta Tantalum 73	W Tungsten 74	Ir Iridium 77	Pt Platinum 78	Hg Mercury 80	Rn Radon 86
87	88											89	91	93	96	101	131
87	88											Y Yttrium 39	Zr Zirconium 40	Nb Niobium 41	Mo Molybdenum 42	Ru Ruthenium 44	Xe Xenon 54
87	88											139	179	181	184	190	222
87	88											La Lanthanum 57	Hf Hafnium 72	Ta Tantalum 73	W Tungsten 74	Re Rhenium 75	Rn Radon 86
87	88											227	226	227	227	227	222
87	88											Fr Francium 87	Ra Radium 88	Ac Actinium 89	Th Thorium 90	Pa Protactinium 91	Rn Radon 86

Key
Relative atomic mass
Symbol
Name
Atomic number



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)

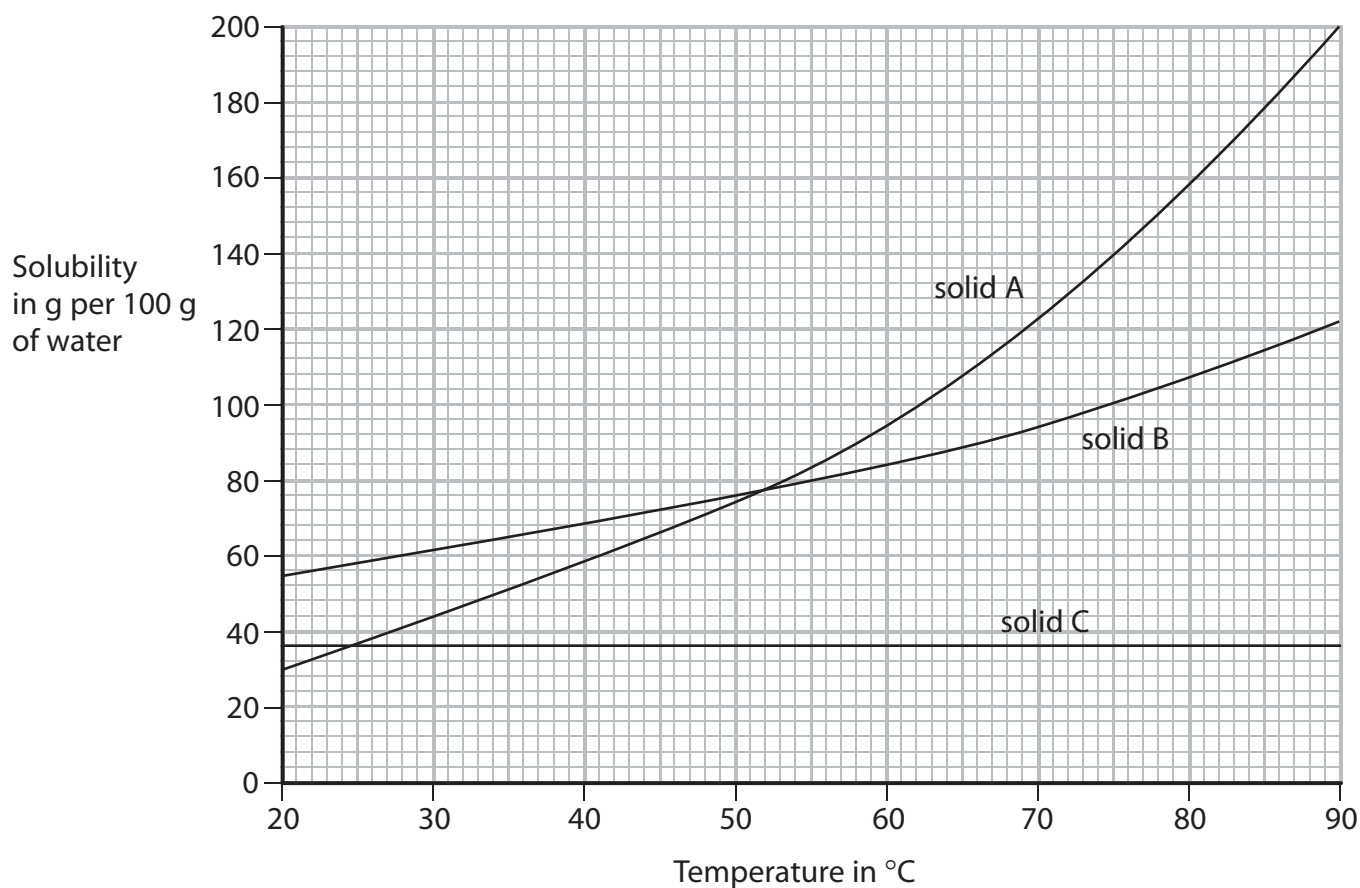
(Total for Question 1 = 3 marks)



- 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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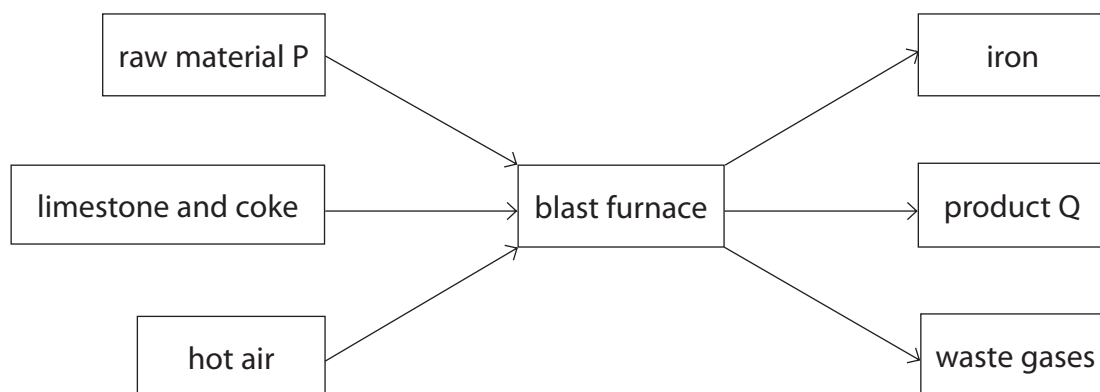
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(Total for Question 2 = 4 marks)



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



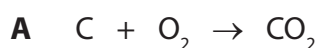
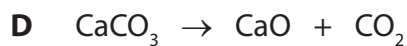
(a) Give the name of raw material P and of product Q.

(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)



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.

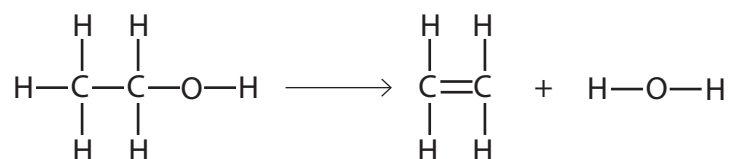
State the pressure used and name the catalyst.

(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 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.

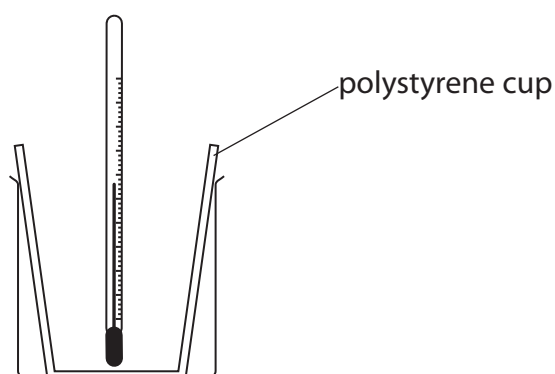
(4)

enthalpy change = kJ/mol

(Total for Question 4 = 15 marks)



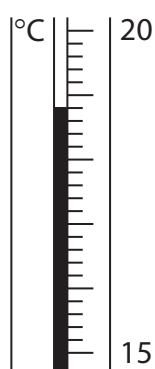
- 5 A student uses this apparatus to investigate the temperature change that occurs when potassium hydroxide is dissolved in water.



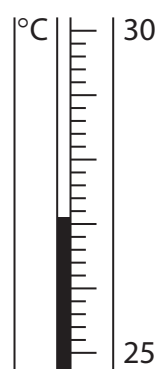
She uses this method.

- pour 50 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 kJ/mol .

Data book value = -55 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

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2

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(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)

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

(3)

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(Total for Question 6 = 7 marks)

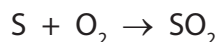


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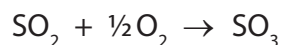


7 Sulfuric acid can be manufactured from sulfur in a four-stage process.

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 = 1.0×10^6 g]

(3)

maximum mass =tonnes



- (c) Calculate the minimum volume at rtp, in cubic decimetres (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 dm^3]

(2)

volume of oxygen = dm^3

(Total for Question 7 = 6 marks)



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 (NO_2) is a brown gas.

Dinitrogen tetraoxide (N_2O_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°C . This equilibrium mixture is brown in colour.

(a) The sealed container is immersed in hot water at 60°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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