Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

CHEMISTRY **0620/32**

Paper 3 (Extended) **October/November 2015**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
A copy of the Periodic Table is printed on page 12.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

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1 Use your copy of the Periodic Table to help you answer some of these questions.

View solution

(a) Predict the formulae of the following compounds.

(i) nitrogen fluoride .....

(ii) phosphorus sulfide .....

[2]

View solution

(b) Deduce the formulae of the following ions.

(i) selenide .....

(ii) gallium .....

[2]

View solution

(c) Use the following ions to determine the formulae of the compounds.

ions OH^- Cr^{3+} Ba^{2+} SO_4^{2-}

compounds

(i) chromium(III) sulfate .....

(ii) barium hydroxide .....

[2]

[Total: 6]

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2 **(a)** Polluted air contains two oxides of carbon and two oxides of nitrogen. A major source of these pollutants is motor vehicles.

(i) Describe how carbon dioxide and carbon monoxide are formed in motor vehicle engines.

.....

.....

.....

..... [3]

(ii) State **one** adverse effect of each of these gases.

View solution

.....

..... [2]

(iii) Nitrogen monoxide, NO, is released by motor vehicle exhausts.

Explain how nitrogen monoxide is formed in motor vehicle engines.

.....

..... [2]

(iv) When nitrogen monoxide is released into the atmosphere, nitrogen dioxide, NO_2, is formed.

Suggest an explanation why this happens.

..... [1]

(b) Predict the possible adverse effect on the environment when this non-metal oxide, NO_2, reacts with water and oxygen.

.....

..... [2]

(c) How are the amounts of carbon monoxide and nitrogen monoxide emitted by modern motor vehicles reduced? Include an equation in your answer.

.....

.....

..... [3]

[Total: 13]

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3 Two of the main uses of zinc are for galvanising and for making alloys.

One of the main ores of zinc is zinc blende, ZnS. There are two stages in the extraction of zinc from this ore.

(a) Stage 1 Zinc oxide is made from zinc blende.

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Describe how this is done and write a word equation for the reaction.

.....

.....

..... [2]

(b) Stage 2 Zinc oxide is reduced to zinc.

View solution

Write a word equation for the reduction of zinc oxide by coke.

..... [1]

(c) The zinc produced by this process is impure. It can be purified by electrolysis using a method which is similar to the purification of copper. Under the conditions used in the process, zinc is the product at the negative electrode (cathode).

View solution

Complete the following description of this purification.

The electrolyte is aqueous ..... . [1]

The negative electrode (cathode) is made of ..... . [1]

The positive electrode (anode) is impure zinc.

The equation for the reaction at the cathode is ..... . [1]

The equation for the reaction at the anode is ..... . [1]

Explain why the concentration of the electrolyte does **not** change.

.....

..... [2]

(d) Brass is an alloy which contains zinc.

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(i) Name the other metal in brass.

..... [1]

(ii) Suggest **two** reasons why an alloy such as brass is preferred to either of its constituent metals.

.....

..... [2]

(e) In an experiment to investigate the rate of rusting of steel, three pieces of steel were used. One piece of steel was completely coated with copper, one piece completely coated with zinc and the third piece was left uncoated. All three pieces were left exposed to the atmosphere.

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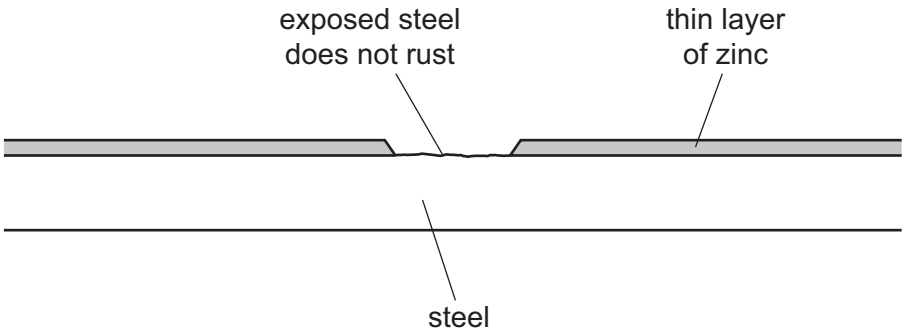
(i) Explain why the uncoated piece started to rust.

.....

..... [1]

(ii) The coating on both of the other two pieces was scratched, exposing the steel.

View solution



The piece of steel coated with zinc still did not rust but the copper-coated piece of steel rusted very rapidly.

Explain these observations in terms of the formation of ions and the transfer of electrons.

.....

.....

.....

.....

..... [4]

[Total: 17]

4 **(a)** Propane reacts with chlorine to form a mixture of chloropropanes. This is a photochemical reaction.

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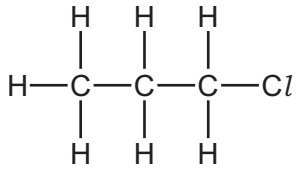
(i) What is meant by the phrase *photochemical reaction*?

.....

..... [1]

(ii) The products of this reaction include two isomers, one of which has the following structural formula.

View solution



Draw the structural formula of the other isomer.

[1]

(iii) Explain why these two different compounds are isomers.

View solution

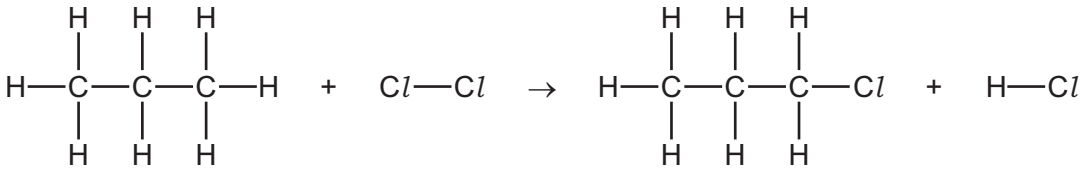
.....

..... [2]

(b) Bond breaking is an endothermic change and bond forming is an exothermic change.

Bond energy is the amount of energy in kJ / mol needed to break one mole of the specified bond.

View solution



Use the following bond energies to determine whether this reaction is exothermic or endothermic. You must show your reasoning.

bond	bond energies in kJ / mol
C–C*l*	338
C–H	412
C*l*–C*l*	242
H–C*l*	431
C–C	348

.....

.....

.....

..... [3]

(c) (i) Chloropropane can be hydrolysed to propanol, $CH_3CH_2CH_2OH$, by sodium hydroxide.

View solution

Write the equation for this reaction.

..... [2]

(ii) Propanol can be dehydrated. It loses a water molecule to form a hydrocarbon.

View solution

Give the name and structural formula of this hydrocarbon.

name .....

structural formula

[2]

(iii) Propanol is oxidised to a carboxylic acid by acidified potassium manganate(VII).

View solution

Deduce the name of this acid.

..... [1]

(d) Propanol reacts with methanoic acid to form the ester propyl methanoate.

View solution

$$CH_3CH_2CH_2OH + HCOOH \rightarrow HCOOCH_2CH_2CH_3 + H_2O$$

4.0 g of methanoic acid was reacted with 6.0 g of propanol.

(i) Calculate the M_r of methanoic acid = ... [1]

(ii) Calculate the M_r of propanol = ... [1]

(iii) Determine which one is the limiting reagent. Show your reasoning.

.....

.....

..... [2]

(iv) Calculate the maximum yield in grams of propyl methanoate, M_r = 88.

..... [1]

[Total: 17]

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5 Iron is extracted from its ore, hematite, in a blast furnace.

Substances added to the furnace are:

- iron ore, hematite, containing impurities such as silica, SiO_2
- air
- coke, C
- limestone, $CaCO_3$

Substances formed in the blast furnace are:

- molten iron
- molten slag
- waste gases such as carbon dioxide

(a) State the **two** functions of the coke used in the blast furnace.

View solution

.....

..... [2]

(b) Write an equation for the conversion of hematite, Fe_2O_3, to iron.

View solution

..... [2]

(c) Explain how the silica impurity is removed and separated from the molten iron.

View solution

.....

.....

.....

..... [3]

(d) The molten iron from the furnace is impure.
It contains impurities which include the element carbon.

View solution

Explain how the carbon is removed. Include an equation in your answer.

.....

.....

..... [3]

[Total: 10]

6 The table below shows the elements in the third period of the Periodic Table, the number of electrons in their outer energy level, their oxidation state in their common compounds and their melting points.

element	Na	Mg	A*l*	Si	P	S	C*l*	Ar
number of outer electrons	1	2	3	4	5	6	7	8
oxidation state	+1	+2	+3	+4 / –4	–3	–2	–1	0
melting point / °C	98	650	660	1414	317	115	–101	–189

(a) Describe and explain the variation in oxidation state across the period.

View solution 

.....

.....

..... [3]

(b) The first three elements, Na, Mg and A*l*, are metals.


View solution

Describe the structure of a typical metal.

.....

.....

..... [3]

(c) Explain why Na, Mg and A*l* are good conductors of electricity.


View solution

..... [1]

(d) Which element exists as diatomic molecules of the type X_2?


View solution

..... [1]

(e) Silicon has a similar structure to diamond.


View solution

Explain why silicon has the highest melting point in the period.

.....

..... [2]

(f) Sodium chloride is a crystalline solid with a high melting point. It dissolves in water to give a neutral solution. Phosphorus trichloride is a liquid at room temperature. It reacts with water to form an acidic solution.

View solution

Suggest an explanation for these differences in properties.

.....

.....

..... [2]

(g) Describe how you could show that magnesium oxide is a basic oxide and not an amphoteric oxide.

.....

..... [2]

(h) Draw a dot-and-cross diagram showing the bonding in magnesium oxide. Show outer electrons only.

View solution

[3]

[Total: 17]

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DATA SHEET
The Periodic Table of the Elements

Group																		
I	II										III	IV	V	VI	VII	0
																4 **He** Helium 2
					1 **H** Hydrogen 1											
7 **Li** Lithium 3	9 **Be** Beryllium 4										11 **B** Boron 5	12 **C** Carbon 6	14 **N** Nitrogen 7	16 **O** Oxygen 8	19 **F** Fluorine 9	20 **Ne** Neon 10
23 **Na** Sodium 11	24 **Mg** Magnesium 12										27 **Al** Aluminium 13	28 **Si** Silicon 14	31 **P** Phosphorus 15	32 **S** Sulfur 16	35.5 **Cl** Chlorine 17	40 **Ar** Argon 18
39 **K** Potassium 19	40 **Ca** Calcium 20	45 **Sc** Scandium 21	48 **Ti** Titanium 22	51 **V** Vanadium 23	52 **Cr** Chromium 24	55 **Mn** Manganese 25	56 **Fe** Iron 26	59 **Co** Cobalt 27	59 **Ni** Nickel 28	64 **Cu** Copper 29	65 **Zn** Zinc 30	70 **Ga** Gallium 31	73 **Ge** Germanium 32	75 **As** Arsenic 33	79 **Se** Selenium 34	80 **Br** Bromine 35	84 **Kr** Krypton 36
85 **Rb** Rubidium 37	88 **Sr** Strontium 38	89 **Y** Yttrium 39	91 **Zr** Zirconium 40	93 **Nb** Niobium 41	96 **Mo** Molybdenum 42	**Tc** Technetium 43	101 **Ru** Ruthenium 44	103 **Rh** Rhodium 45	106 **Pd** Palladium 46	108 **Ag** Silver 47	112 **Cd** Cadmium 48	115 **In** Indium 49	119 **Sn** Tin 50	122 **Sb** Antimony 51	128 **Te** Tellurium 52	127 **I** Iodine 53	131 **Xe** Xenon 54
133 **Cs** Caesium 55	137 **Ba** Barium 56	139 **La** Lanthanum 57 *	178 **Hf** Hafnium 72	181 **Ta** Tantalum 73	184 **W** Tungsten 74	186 **Re** Rhenium 75	190 **Os** Osmium 76	192 **Ir** Iridium 77	195 **Pt** Platinum 78	197 **Au** Gold 79	201 **Hg** Mercury 80	204 **Tl** Thallium 81	207 **Pb** Lead 82	209 **Bi** Bismuth 83	**Po** Polonium 84	**At** Astatine 85	**Rn** Radon 86
Fr Francium 87	226 **Ra** Radium 88	227 **Ac** Actinium 89 †															

140 **Ce** Cerium 58	141 **Pr** Praseodymium 59	144 **Nd** Neodymium 60	**Pm** Promethium 61	150 **Sm** Samarium 62	152 **Eu** Europium 63	157 **Gd** Gadolinium 64	159 **Tb** Terbium 65	162 **Dy** Dysprosium 66	165 **Ho** Holmium 67	167 **Er** Erbium 68	169 **Tm** Thulium 69	173 **Yb** Ytterbium 70	175 **Lu** Lutetium 71
232 **Th** Thorium 90	**Pa** Protactinium 91	238 **U** Uranium 92	**Np** Neptunium 93	**Pu** Plutonium 94	**Am** Americium 95	**Cm** Curium 96	**Bk** Berkelium 97	**Cf** Californium 98	**Es** Einsteinium 99	**Fm** Fermium 100	**Md** Mendelevium 101	**No** Nobelium 102	**Lr** Lawrencium 103

*58-71 Lanthanoid series
†90-103 Actinoid series

Key: a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

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