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Surname					Other names									
Pearson					Centre Number					Candidate Number				
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Chemistry														
Unit C3: Chemistry in Action														
Higher Tier														
Wednesday 17 June 2015 – Morning										Paper Reference				
Time: 1 hour										5CH3H/01				
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.*

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.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
– *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

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

Turn over ►

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PEARSON

The Periodic Table of the Elements

1	2	3	4	5	6	7	0																																																																			
7 Li lithium 3	9 Be beryllium 4	23 Na sodium 11	24 Mg magnesium 12	39 K potassium 19	40 Ca calcium 20	85 Rb rubidium 37	88 Sr strontium 38	133 Cs caesium 55	137 Ba barium 56	223 Fr francium 87	226 Ra radium 88	227 Ac* actinium 89	261 Rf rutherfordium 104	262 Db dubnium 105	266 Sg seaborgium 106	264 Bh bohrium 107	277 Hs hassium 108	268 Mt meitnerium 109	271 Ds darmstadtium 110	272 Rg roentgenium 111	201 Hg mercury 80	197 Au gold 79	192 Ir iridium 77	190 Os osmium 76	186 Re rhenium 75	184 W tungsten 74	181 Ta tantalum 73	178 Hf hafnium 72	139 La* lanthanum 57	139 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	98 Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	127 I iodine 53	128 Te tellurium 52	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	209 Po polonium 84	210 At astatine 85	222 Rn radon 86	70 Ga gallium 31	65 Zn zinc 30	59 Ni nickel 28	59 Co cobalt 27	56 Fe iron 26	55 Mn manganese 25	52 Cr chromium 24	48 Ti titanium 22	45 Sc scandium 21	27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10	4 He helium 2

1
H
hydrogen
1

Key
relative atomic mass
atomic symbol
name
atomic (proton) number

Elements with atomic numbers 112-116 have been reported but not fully authenticated

* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.



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Questions begin on next page.

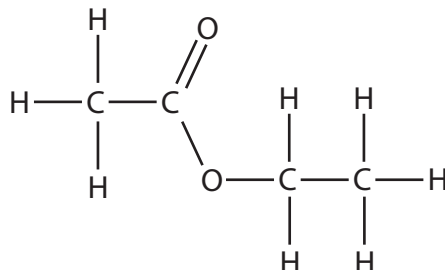


Answer ALL questions

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 ☒.

Saturated and unsaturated organic compounds

- 1 The structure of a molecule of an ester, ethyl ethanoate, is shown.



- (a) (i) Give the molecular formula of this compound.

(1)

- (ii) Write the word equation for the reaction of ethanol with another compound to form ethyl ethanoate and another product.

(2)

- (iii) A hazard from the ethyl ethanoate fact sheet is shown in the box.

Exposure to the vapour of ethyl ethanoate can cause you to feel dizzy or to faint

Suggest why, despite this hazard, it is still safe to use ethyl ethanoate in sweets.

(1)



(b) Vegetable oils and fats are esters.

One of these oils is boiled with concentrated sodium hydroxide solution.
The mixture is poured into concentrated sodium chloride solution.
A white solid is formed.

(i) What type of substance is the white solid?

Put a cross (☒) in the box next to your answer.

(1)

- A alcohol
- B fat
- C polyester
- D soap

(ii) The white solid is formed in a mixture with a solution of other substances.

Describe how a pure sample of the white solid can be obtained from this mixture.

(2)

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(c) Complete the sentence by putting a cross (☒) in the box next to your answer.

Liquid oils can be converted into solid fats by hydrogenation.

In this reaction

(1)

- A a salt and water are formed
- B the liquid oil is reacted with oxygen gas
- C unsaturated molecules in the liquid oil become saturated
- D C=C bonds are formed

(Total for Question 1 = 8 marks)



Identifying salts

- 2 (a) A technician had two bottles containing solid salts. One bottle contained a potassium salt and the other contained a sodium salt. Unfortunately the labels had fallen off the bottles. The technician tested the salts to find the ions present.

- (i) Complete the sentence by putting a cross (☒) in the box next to your answer.

Both salts contained the same anion.

A solution of one salt was made and some dilute nitric acid was added. Drops of silver nitrate solution were added. A yellow precipitate formed.

This test shows the anion in the salt is

(1)

- A bromide, Br^-
- B chloride, Cl^-
- C iodide, I^-
- D sulfate, SO_4^{2-}

- (ii) The technician wanted to find out which bottle contained the sodium salt and which bottle contained the potassium salt.

Explain how the technician should do this.

(2)

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(b) When sodium hydroxide solution is mixed with a solution containing copper ions, Cu^{2+} , copper hydroxide, $\text{Cu}(\text{OH})_2$, is formed.

(i) Describe what you would **see** when these solutions are mixed.

(2)

(ii) Write the ionic equation for this reaction.

(3)

(Total for Question 2 = 8 marks)



Ethanol

3 (a) Ethanol is produced by the fermentation of glucose.

Yeast is needed for the fermentation reaction.

(i) State **two** other conditions for fermentation.

(2)

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

A dilute solution of ethanol can be converted to a concentrated solution of ethanol by

(1)

- A filtration
- B fractional distillation
- C dehydration
- D cracking

(iii) Write the balanced equation for the fermentation of glucose, $C_6H_{12}O_6$.

(2)



(b) In industry, ethene is converted to ethanol.

(i) State **two** conditions for this reaction.

(2)

(ii) A country has large reserves of crude oil.

It is a relatively wealthy country with a large population but it has only a small amount of fertile land.

Explain why the country would prefer to produce its ethanol from ethene rather than by fermentation.

(3)

(Total for Question 3 = 10 marks)



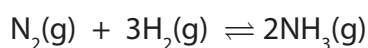
Gases

- 4 (a) Propene is a gaseous hydrocarbon.

Draw the structure of a molecule of propene, showing all bonds.

(2)

- (b) Nitrogen reacts with hydrogen to form ammonia.



- (i) Calculate the minimum volume of nitrogen, in dm^3 , required to react completely with 1000 dm^3 of hydrogen.

All volumes are measured at the same temperature and pressure.

Put a cross (☒) in the box next to your answer.

(1)

- A** 333 dm^3
- B** 1000 dm^3
- C** 3000 dm^3
- D** 4666 dm^3

- (ii) The minimum volumes of nitrogen and hydrogen that must react completely to form 5000 dm^3 of ammonia are calculated.

These volumes are mixed and left, under appropriate conditions, until the reaction reaches equilibrium.

Explain which gas or gases will be present when equilibrium is reached.

(2)

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(iii) The Haber process is carried out under a pressure of about 200 atm.

Explain the effect on the **equilibrium yield** of ammonia, if the process is carried out at a pressure higher than 200 atm.

(2)

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(iv) Explain the effect on the **rate of attainment of equilibrium**, if the process is carried out at a pressure higher than 200 atm.

(3)

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(Total for Question 4 = 10 marks)



Water

- 5 (a) A solution is made by dissolving calcium chloride in water.

11.1 g of calcium chloride are dissolved in water.

The volume of the solution is made up to 500 cm³.

Calculate the concentration, in mol dm⁻³, of calcium chloride, CaCl₂, in this solution.

(relative atomic masses: Cl = 35.5, Ca = 40.0)

(3)

concentration = mol dm⁻³

- (b) The concentration of a solution of an alkali can be determined by titration with an acid.

25.0 cm³ portions of the solution of the alkali are transferred into a conical flask and titrated with the acid solution, using a suitable indicator.

- (i) Describe how you would measure out and transfer 25.0 cm³ of the solution of the alkali.

(2)



(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The burette readings of acid added were

	titration 1	titration 2	titration 3
final volume / cm ³	27.20	30.10	25.35
initial volume / cm ³	2.05	5.20	0.10
volume of acid added / cm ³	25.15	24.90	25.25

The volume of acid added that should be used in the calculation is

(1)

- A 24.90 cm³
- B 25.00 cm³
- C 25.10 cm³
- D 25.20 cm³

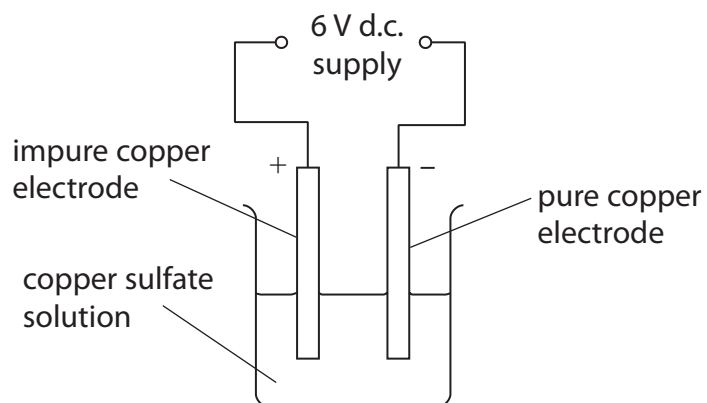


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Electrolysis

- 6 (a) Impure copper is purified by electrolysis using the apparatus shown.



- (i) Give the name of the electrode which is made of pure copper.

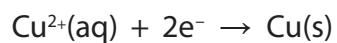
(1)

- (ii) Describe how each electrode will have changed at the end of the electrolysis process.

(2)



(iii) Complete the sentence by putting a cross (☒) in the box next to your answer.



This half equation shows the process of

(1)

- A displacement
- B oxidation
- C redox
- D reduction

(iv) Copper sulfate solution is the electrolyte used in this electrolysis process.

Explain how copper sulfate solution conducts electricity.

(2)

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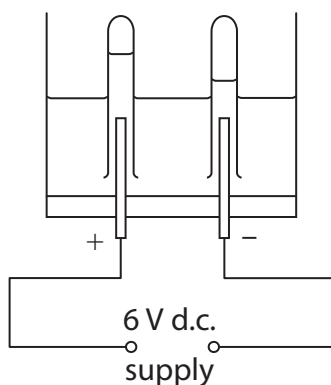
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(b) Sodium sulfate solution is electrolysed in the apparatus shown.



Sodium sulfate solution contains sodium ions, Na^+ , sulfate ions, SO_4^{2-} , hydrogen ions, H^+ , and hydroxide ions, OH^- .

Hydrogen is produced at one electrode and oxygen is produced at the other electrode.

Explain how these products are formed from the ions in the electrolysis process, indicating how you would identify the products.

You may give ionic equations in your answer.

(6)

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(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS



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