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0620/43

October/November 2016

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.

This document consists of **12** printed pages.



1 (a) Complete the table.

particle	charge	relative mass
proton	+1	
neutron		1
electron		

[2]

(b) The following are isotopes of carbon.



(i) In terms of numbers of protons, neutrons and electrons, how are these **three** isotopes the same and how are they different?

They are the same because

.....

They are different because

.....

[3]

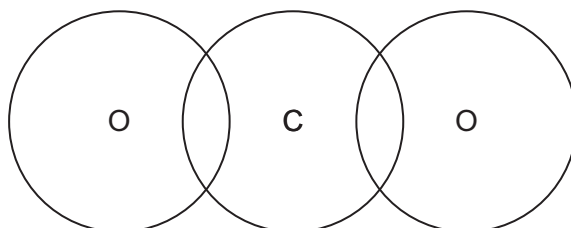
(ii) Why do all isotopes of carbon have the same chemical properties?

..... [1]

(c) Name **two** forms of the element carbon which have giant covalent structures.

..... and [1]

(d) Complete the diagram to show the electron arrangement in a carbon dioxide molecule. Show the outer shell electrons only.



[2]

[Total: 9]

2 Beryllium is a metallic element in Group II.

(a) Give the electronic structure of a beryllium atom.

..... [1]

(b) Give the formula of beryllium oxide.

..... [1]

(c) (i) Describe the bonding in a metallic element such as beryllium.
Include a labelled diagram and any appropriate charges in your answer.

.....
.....
..... [3]

(ii) Explain why metallic elements, such as beryllium, are good conductors of electricity.

.....
..... [1]

(d) Beryllium hydroxide is amphoteric.
Beryllium hydroxide reacts with acids. The salts formed contain positive beryllium ions.

(i) Give the formula of the positive beryllium ion.

..... [1]

(ii) Write a chemical equation for the reaction between beryllium hydroxide and hydrochloric acid.

..... [2]

(iii) Beryllium hydroxide also reacts with alkalis. The salts formed contain beryllate ions, BeO_2^{2-} .

Suggest a chemical equation for the reaction between beryllium hydroxide and sodium hydroxide solution.

..... [2]

[Total: 11]

- 3 When lead(II) nitrate is heated, two gases are given off and solid lead(II) oxide remains. The equation for the reaction is shown.



- (a) Calculate the M_r of lead(II) nitrate.

..... [1]

- (b) 6.62 g of lead(II) nitrate are heated until there is no further change in mass.

- (i) Calculate the mass of lead(II) oxide produced.

..... g [2]

- (ii) Calculate the volume of oxygen, O_2 , produced at room temperature and pressure (r.t.p.).

..... dm^3 [2]

- (c) Describe a test for oxygen.

test

result

[2]

(d) Lead(II) oxide is insoluble. A student adds solid lead(II) oxide to dilute nitric acid until the lead(II) oxide is in excess. Aqueous lead(II) nitrate and water are produced.

(i) What is meant by the term *excess*?

..... [1]

(ii) How would the student know when the lead(II) oxide is in excess?

..... [1]

(iii) Write a chemical equation for the reaction.

..... [1]

[Total: 10]

4 Silicon(IV) oxide and sodium chloride have different types of bonding and structure.

(a) Name the type of bonding present in

silicon(IV) oxide,

sodium chloride.

[2]

(b) Name the type of structure present in silicon(IV) oxide.

..... [1]

(c) (i) Silicon(IV) oxide has a high melting point. Explain why.

.....

..... [2]

(ii) Silicon(IV) oxide is a poor conductor of electricity. Explain why.

..... [1]

(d) Solid sodium chloride does not conduct electricity. However, it conducts electricity when molten.

Explain why solid sodium chloride does **not** conduct electricity, whereas molten sodium chloride does conduct electricity.

.....

.....

.....

..... [3]

(e) A **concentrated** aqueous solution of sodium chloride is electrolysed using carbon electrodes.

(i) Name the products formed at the electrodes.

product at the positive electrode (anode)

product at the negative electrode (cathode)

[2]

(ii) Write an ionic half-equation for the reaction occurring at the negative electrode.

..... [1]

- (f) A **dilute** aqueous solution of sodium chloride is electrolysed using carbon electrodes.

Name the main product formed at the positive electrode.

..... [1]

- (g) Molten sodium chloride is electrolysed using carbon electrodes.

- (i) Name the product formed at the negative electrode.

..... [1]

- (ii) Write an ionic half-equation for the reaction occurring at the negative electrode.

..... [1]

- (iii) Chlorine is produced at the positive electrode.

Give the test for chlorine.

test

result

[2]

[Total: 17]

- 5 Sulfuric acid can be manufactured from the raw materials sulfur, air and water. The process can be divided into four stages.

- stage 1** converting sulfur into sulfur dioxide
stage 2 converting sulfur dioxide into sulfur trioxide
stage 3 converting sulfur trioxide into oleum, $\text{H}_2\text{S}_2\text{O}_7$
stage 4 converting oleum into sulfuric acid

stage 1

- (a) (i) Describe how sulfur is converted into sulfur dioxide.

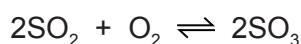
..... [1]

- (ii) Write a chemical equation for the conversion of sulfur into sulfur dioxide.

..... [1]

stage 2

- (b) Sulfur dioxide is converted into sulfur trioxide according to the following equation.



The reaction is carried out at a temperature of 450°C and a pressure of 1–2 atmospheres using a catalyst. The energy change, ΔH , for the reaction is -196 kJ/mol .

- (i) What is the meaning of the symbol $\rightleftharpoons$?

..... [1]

- (ii) Name the catalyst used in this reaction.

..... [1]

- (iii) Why is a catalyst used?

..... [1]

- (iv) If a temperature higher than 450°C were used, what would happen to the amount of sulfur trioxide produced? Give a reason for your answer.

.....
 [2]

- (v) Suggest a reason why a temperature lower than 450°C is **not** used.

.....
 [1]

- (vi) If a pressure higher than 1–2 atmospheres were used, what would happen to the amount of sulfur trioxide produced? Give a reason for your answer.

.....
 [2]

stage 3

- (c) (i) What is added to sulfur trioxide to convert it into oleum?

..... [1]

- (ii) Write a chemical equation for the conversion of sulfur trioxide into oleum.

..... [1]

stage 4

- (d) (i) What is added to oleum to convert it into sulfuric acid?

..... [1]

- (ii) Write a chemical equation for the conversion of oleum into sulfuric acid.

..... [1]

- (e) Give **one** use of sulfuric acid.

..... [1]

- (f) Sulfuric acid reacts with a hydrocarbon called benzene to produce benzenesulfonic acid, $\text{C}_6\text{H}_5\text{SO}_3\text{H}$. Benzenesulfonic acid is a strong acid which ionises to produce hydrogen ions, H^+ , and benzenesulfonate ions, $\text{C}_6\text{H}_5\text{SO}_3^-$.

- (i) What is meant by the term *strong acid*?

..... [1]

- (ii) Describe how to show that a 1 mol/dm^3 solution of benzenesulfonic acid is a strong acid.

.....
 [2]

- (iii) Write a chemical equation for the reaction between benzenesulfonic acid and sodium carbonate, Na_2CO_3 .

..... [2]

[Total: 20]

6 Synthetic polyamides are made by condensation polymerisation.

(a) (i) What is meant by the term *condensation polymerisation*?

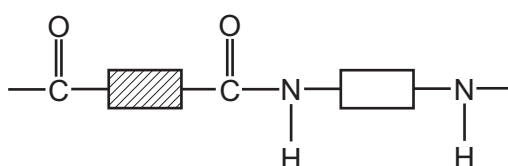
.....

 [3]

(ii) Name another type of polymerisation.

..... [1]

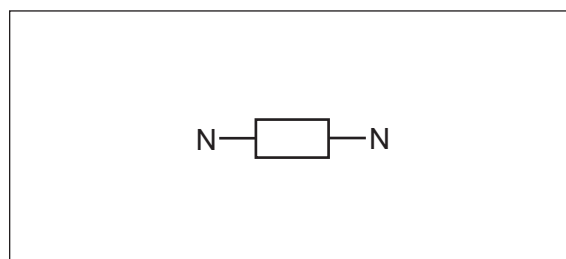
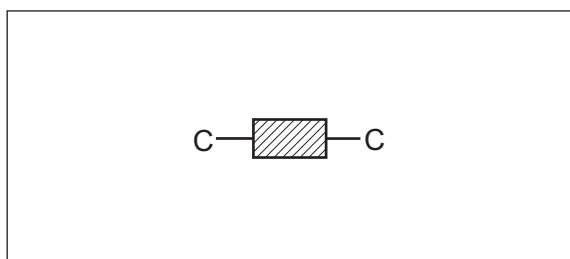
(b) One repeat unit of a synthetic polyamide is represented by the following structure.



(i) Draw a ring around the amide link.

[1]

(ii) Complete the diagrams to show the structures of the monomers used to produce the synthetic polyamide. Show all the missing atoms and bonds.



[2]

(iii) Name an example of a synthetic polyamide.

..... [1]

(c) Proteins and synthetic polyamides have similarities and differences.

(i) Name the type of compounds that are the monomers used to make up proteins.

..... [1]

- (ii) Starting with a sample of protein, describe how to produce, separate, detect and identify the monomers which make it up.

Your answer should include

- the name of the process used to break down the protein into its monomers,
- the name of the process used to separate the monomers,
- the method used to detect the monomers after they have been separated,
- the method used to identify the monomers after they have been separated.

.....

.....

.....

.....

..... [4]

[Total: 13]

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The Periodic Table of Elements

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3 Li lithium 7	4 Be beryllium 9	1 H hydrogen 1										5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	2 He helium 4																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
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11 Na sodium 23	12 Mg magnesium 24	13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40	19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium —	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131	55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium —	85 At astatine —	86 Rn radon —																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
87 Fr francium —	88 Ra radium —	89–103 actinoids	104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —	111 Rg roentgenium —	112 Cn copernicium —	113 Nh nihonium —	114 Fl flerovium —	115 Lv livermorium —	116 Ts tennessine —	117 Uue unbinilium —	118 Og oganeson —	119 Uuh ununilium —	120 Uut ununium —	121 Uuq ununquadium —	122 Uub ununbium —	123 Uut ununtrium —	124 Uuq ununquadium —	125 Uub ununbium —	126 Uut ununtrium —	127 Uuq ununquadium —	128 Uub ununbium —	129 Uut ununtrium —	130 Uuq ununquadium —	131 Uub ununbium —	132 Uut ununtrium —	133 Uuq ununquadium —	134 Uub ununbium —	135 Uut ununtrium —	136 Uuq ununquadium —	137 Uub ununbium —	138 Uut ununtrium —	139 Uuq ununquadium —	140 Uub ununbium —	141 Uut ununtrium —	142 Uuq ununquadium —	143 Uub ununbium —	144 Uut ununtrium —	145 Uuq ununquadium —	146 Uub ununbium —	147 Uut ununtrium —	148 Uuq ununquadium —	149 Uub ununbium —	150 Uut ununtrium —	151 Uuq 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ununtrium —	544 Uuq ununquadium —	545 Uub ununbium —	546 Uut ununtrium —	547 Uuq ununquadium —	548 Uub ununbium —	549 Uut ununtrium —	550 Uuq ununquadium —	551 Uub ununbium —	552 Uut ununtrium —	553 Uuq ununquadium —	554 Uub ununbium —	555 Uut ununtrium —	556 Uuq ununquadium —	557 Uub ununbium —	558 Uut ununtrium —	559 Uuq ununquadium —	560 Uub ununbium —	561 Uut ununtrium —	562 Uuq ununquadium —	563 Uub ununbium —	564 Uut ununtrium —	565 Uuq ununquadium —	566 Uub ununbium —	567 Uut ununtrium —	568 Uuq ununquadium —	569 Uub ununbium —	570 Uut ununtrium —	571 Uuq ununquadium —	572 Uub ununbium —	573 Uut ununtrium —	574 Uuq ununquadium —	575 Uub ununbium —	576 Uut ununtrium —	577 Uuq ununquadium —	578 Uub ununbium —	579 Uut ununtrium —	580 Uuq ununquadium —	581 Uub ununbium —	582 Uut ununtrium —	583 Uuq ununquadium —	584 Uub ununbium —	585 Uut ununtrium —	586 Uuq ununquadium —	587 Uub ununbium —	588 Uut ununtrium —	589 Uuq ununquadium —	590 Uub ununbium —	591 Uut ununtrium —	592 Uuq ununquadium —	593 Uub ununbium —	594 Uut ununtrium —	595 Uuq ununquadium —	596 Uub ununbium —	597 Uut ununtrium —	598 Uuq ununquadium —	599 Uub ununbium —	600 Uut ununtrium —	601 Uuq ununquadium —	602 Uub ununbium —	603 Uut ununtrium —	604 Uuq ununquadium —	605 Uub ununbium —	606 Uut ununtrium —	607 Uuq ununquadium —	608 Uub ununbium —	609 Uut ununtrium —	610 Uuq ununquadium —	611 Uub ununbium —	612 Uut ununtrium —	613 Uuq ununquadium —	614 Uub ununbium —	615 Uut ununtrium —	616 Uuq ununquadium —	617 Uub ununbium —	618 Uut ununtrium —	619 Uuq ununquadium —	620 Uub ununbium —	621 Uut ununtrium —	622 Uuq ununquadium —	623 Uub ununbium —	624 Uut ununtrium —	625 Uuq ununquadium —	626 Uub ununbium —	627 Uut ununtrium —	628 Uuq ununquadium —	629 Uub ununbium —	630 Uut ununtrium —	631 Uuq ununquadium —	632 Uub ununbium —	633 Uut ununtrium —	634 Uuq ununquadium —	635 Uub ununbium —	636 Uut ununtrium —	637 Uuq ununquadium —	638 Uub