

**Cambridge O Level 5070 Syllabus**

# **CHEMISTRY**

## **TOPICAL PAPER 1**

for Cambridge 2022 and cbk Uf Xg Exams

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2022-2014 | All variants

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### Topic 1.2: Diffusion

1 ) \$+\$/%&/A/>/2&/Q( ) \$+\$/%&/A/>/2&/Q(

- 1 Ethylamine gas,  $C_2H_5NH_2$ , and hydrogen chloride gas,  $HCl$ , react together to form a white solid, ethylamine hydrochloride.

At which position in the tube would a ring of solid white ethylamine hydrochloride form?



2 ) \$+\$/%&/A/>/2&/Q(

- 2 Which row correctly describes changes in the particles when a substance freezes?

	arrangement of the particles	energy change in the particles
<b>A</b>	particles become more ordered	particles gain energy
<b>B</b>	particles become more ordered	particles lose energy
<b>C</b>	particles become less ordered	particles gain energy
<b>D</b>	particles become less ordered	particles lose energy

3 ) \$+\$/%&/A/>/8%/Q\*

- 3 Which statement about states of matter is correct?

- A** When a liquid freezes it becomes a solid and energy is released to the surroundings.  
**B** When a liquid reaches its boiling point it becomes a gas. This process is called evaporation.  
**C** When a solid changes directly to a gas the process is called condensation.  
**D** When a solid melts the particles get further apart and have less energy.

4 ) \$+\$/%&/C/B/2%/Q+

- 4 A sample of gas is released at a particular point in a laboratory.

A detecting device is placed ten metres from the point where the gas is released. This device detects and records the time when the concentration of the gas is ten molecules in every million molecules of air.

The experiment is carried out with two gases at different temperatures.

In which experiment was the time recorded by the detector **greatest**?

	gas	temperature of laboratory / °C
<b>A</b>	$SF_6$	20
<b>B</b>	$SF_6$	40
<b>C</b>	$CO_2$	20
<b>D</b>	$CO_2$	40

) \$+\$/%/%C/B/2%Q+

- 5 The rate of diffusion of carbon dioxide and methane is investigated at two different temperatures, one high and one low.

Which row correctly shows the gas that diffuses faster and the temperature at which diffusion takes place most rapidly?

	gas	temperature
<b>A</b>	carbon dioxide	high
<b>B</b>	carbon dioxide	low
<b>C</b>	methane	high
<b>D</b>	methane	low

) \$+\$/%/%C/B/&amp;\$Q+

- 6 Why does a balloon full of helium gas become smaller as the temperature changes from 30 °C to 10 °C?

- A** The gas condenses to a liquid and so takes up less space.  
**B** The gas particles become smaller at lower temperatures.  
**C** The gas particles diffuse through the balloon and escape.  
**D** The gas particles move more slowly so reducing the pressure.

) \$+\$/%&amp;M/J%/Q4

- 7 Which gas will diffuse at the fastest rate at the same temperature and pressure?

- A** Ar                      **B** C<sub>3</sub>H<sub>8</sub>                      **C** CO<sub>2</sub>                      **D** F<sub>2</sub>

) \$+\$/%&amp;M/J%/Q4

- 8 Which conditions will give the highest rate of diffusion of a gas?

	molecular mass of gas	temperature
<b>A</b>	large	high
<b>B</b>	large	low
<b>C</b>	small	high
<b>D</b>	small	low

5070/12/O/N/16/Q4

- 9 Benzene and cyclohexane are both flammable liquids. They are able to mix with each other without separating into two layers. They have very similar boiling points. It is difficult to separate a mixture of these two liquids by fractional distillation.

Why is it difficult to separate a mixture of benzene and cyclohexane by fractional distillation?

- A** They are both flammable.                      **C** They have very similar boiling points.  
**B** They are both liquids.                      **D** They mix with each other completely.

### Topic 2.1: Elements, Compounds & Mixture

1) Which row is correct?

1 Which row is correct?

	elements	compounds	mixtures
<b>A</b>	graphite, iron	methane, water	air, copper
<b>B</b>	graphite, iron	sand, water	air, brass
<b>C</b>	iron, water	methane, graphite	air, brass
<b>D</b>	water, methane	air, graphite	iron, brass

2) Which is a pure compound?

2 Which is a pure compound?

- A dry air
- B ethanol
- C steel
- D petrol (gasoline)

3) Which row shows the numbers of particles in  $^{34}_{16}\text{S}^{2-}$ ?

3 Which row shows the numbers of particles in  $^{34}_{16}\text{S}^{2-}$ ?

	protons	neutrons	electrons
<b>A</b>	16	16	16
<b>B</b>	16	18	18
<b>C</b>	18	16	20
<b>D</b>	20	14	22

### Topic 2.2: Atomic Structure

**5070/12/M/J/22/Q7** ) \$+\$/%&A/>/&&Q\*

- 1 Two isotopes of chlorine are  $^{35}\text{Cl}$  and  $^{37}\text{Cl}$ .

Using these isotopes and  $^{12}\text{C}$  and  $^1\text{H}$ , how many different relative molecular masses are possible for the compound with molecular formula  $\text{C}_2\text{H}_3\text{Cl}_3$ ?

- A 2                      B 3                      C 4                      D 5

**5070/12/M/J/22/Q6**

- 2 Element X can be represented by the symbol  $^{14}_6\text{X}$ .

Which statements about an atom of element X are correct?

- 1 It has 6 electrons.                      3 It is an isotope of carbon.  
2 It has 8 protons.                      4 It is an isotope of nitrogen.

- A 1, 2 and 3      B 1 and 2 only      C 1 and 3 only      D 2 and 4

) \$+\$/%&A/>/&&Q\*

- 3 Two particles have the symbols  $^{54}_{26}\text{Fe}^{2+}$  and  $^{59}_{27}\text{Co}^{3+}$ .

Which statement about these particles is correct?

- A They contain the same number of electrons.  
B They contain the same number of neutrons.  
C They contain the same number of protons.  
D They do not contain the same number of protons, neutrons or electrons.

) \$+\$/%&C/B/&%Q,

- 4 The table shows data for some particles.

particle	proton number	nucleon number	number of protons	number of neutrons	number of electrons
sodium ion	11	23	11	W	10
fluoride ion	9	19	9	10	X
magnesium ion	12	24	Y	12	10

What are the values of W, X and Y?

	W	X	Y
<b>A</b>	10	10	12
<b>B</b>	11	12	10
<b>C</b>	12	10	12
<b>D</b>	12	10	10

) \$+\$/%/%A/&gt;/&amp;%/Q\*

5 Which particle contains most electrons?

- A  $O^{3-}$                       B Ne                      C  $Na^{-}$                       D  $Mg^{3+}$

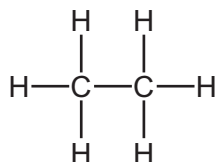
5070/11/M/J/20/Q7

6 Which definition of isotopes is correct?

- A atoms of different elements which have the same number of electrons  
 B atoms of different elements which have the same number of neutrons  
 C atoms of the same element which have different numbers of electrons  
 D atoms of the same element which have different numbers of neutrons

) \$+\$/%/%C/B/&amp;\$/Q%&amp;

7 The diagram shows the covalent bonds in an organic compound.



The total number of electrons in one molecule of this compound is .....X..... .

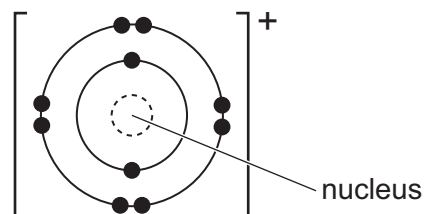
The total number of electrons in the bonds in one molecule of this compound is .....Y..... .

Which numbers correctly complete gaps X and Y?

	X	Y
<b>A</b>	14	12
<b>B</b>	14	14
<b>C</b>	18	12
<b>D</b>	18	14

) \$+\$/%/%C/B/&amp;\$/Q,

8 The diagram of an ion is shown.



What can be deduced about the number of protons in this ion?

- A It has 9 protons.  
 B It has 10 protons.  
 C It has 11 protons  
 D You cannot deduce the number of protons from this diagram.



- 9 Which property is common to  $^{40}\text{Ca}$ ,  $^{39}\text{K}$  and  $^{23}\text{Na}$ ?
- A Their atoms all have more neutrons than protons.  
 B Their ions all have eight electrons in their outer shell.  
 C They all sink when added to water.  
 D They are all deposited at the positive electrode when their molten chloride is electrolysed.

- 10 The nucleon number of an atom is typically greater than its proton number. The difference between these two numbers indicates the number of .....1..... in the atom.

Atoms that have different nucleon numbers but the same proton number are called .....2..... .

Which words correctly complete gaps 1 and 2?

	1	2
A	electrons	isomers
B	electrons	isotopes
C	neutrons	isomers
D	neutrons	isotopes

- 11 Two particles,  $\text{K}^+$  and  $\text{Ar}$ , can be written as  $^{39}_{19}\text{K}^+$  and  $^{40}_{18}\text{Ar}$ .  
 Which statement about these particles is correct?
- A Ar has more neutrons than  $\text{K}^+$ .  
 B K has more nucleons than Ar.  
 C  $\text{K}^+$  has 20 electrons.  
 D  $\text{K}^+$  has a greater mass than Ar.

**5070/11/M/J/18/Q5**

- 12 The ion  $\text{Q}^{2+}$  has three complete shells of electrons. What is Q?
- A calcium      B magnesium      C oxygen      D sulfur

**5070/12/M/J/18/Q5**

- 13 The atomic number of cerium, Ce, is 58. A  $\text{Ce}^{4+}$  ion has 140 nucleons in its nucleus.  
 How many protons, neutrons, and electrons are there in one  $\text{Ce}^{4+}$  ion?

	protons	neutrons	electrons
A	58	82	54
B	58	82	62
C	82	58	54
D	82	58	62

5070/11/M/J/18/Q9

- 14 Which statement is correct?
- A All compounds are ionic.
  - B All compounds conduct electricity when molten.
  - C Each element only contains one type of atom.
  - D In a mixture of substances, the proportions of the substances are always the same.

5070/11/M/J/17/Q4 5070/12/M/J/17/Q4

- 15 Which statement about the particles  ${}^{19}_9\text{F}^-$ ,  ${}^{20}_{10}\text{Ne}$  and  ${}^{23}_{11}\text{Na}^+$  is correct?
- A They all contain more electrons than protons.
  - B They all contain more neutrons than protons.
  - C They all contain the same number of electrons.
  - D They all contain the same number of protons.

5070/11/O/N/17/Q6

- 16 A particle of an isotope of sulfur contains 18 neutrons and 18 electrons.  
What is the symbol for this particle?

A  ${}^{34}_{16}\text{S}^{2+}$       B  ${}^{34}_{16}\text{S}$       C  ${}^{34}_{16}\text{S}^{2-}$       D  ${}^{36}_{16}\text{S}$

5070/12/O/N/17/Q6

- 17 Which particle contains the same number of both neutrons and electrons?

A  ${}^{40}_{20}\text{Ca}^{2+}$       B  ${}^{24}_{12}\text{Mg}^{2+}$       C  ${}^{19}_9\text{F}^-$       D  ${}^{32}_{16}\text{S}^{2-}$

5070/11/O/N/16/Q1

- 18 A student is given only the nucleon number of an atom.

What can be deduced about the structure of the atom?

- A number of neutrons plus protons
- B number of neutrons only
- C number of protons plus electrons
- D number of protons only

5070/11/O/N/16/Q8 5070/12/O/N/16/Q6

- 19 Which statement about chlorine atoms and chloride ions is correct?

- A They are both isotopes of chlorine.
- B They undergo the same chemical reactions.
- C They have the same number of protons.
- D They have the same physical properties.

5070/11/M/J/16/Q5

- 20 The symbols for two ions are shown.

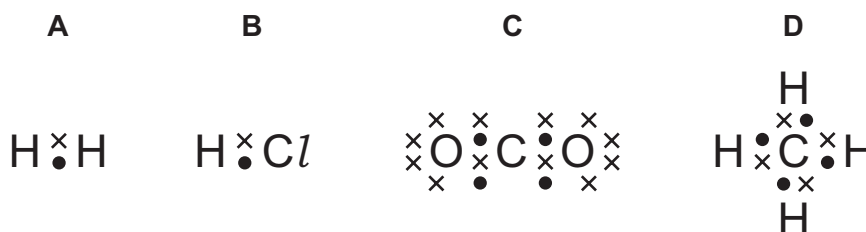


Which statement is correct?

- A The fluoride ion contains more electrons than the sodium ion.  
 B The sodium ion contains more neutrons than the fluoride ion.  
 C The two ions contain the same number of electrons as each other.  
 D The two ions contain the same number of protons as each other.

5070/11/M/J/16/Q6

- 21 Which dot-and-cross diagram, showing all the outer shell electrons of each atom, is **not** correct?



5070/11/M/J/16/Q7

- 22 Which statement shows that graphite and diamond are different forms of the element carbon?
- A Both graphite and diamond have giant molecular structures.  
 B Complete combustion of equal masses of graphite and diamond produces equal masses of carbon dioxide and no other products.  
 C Graphite and diamond have different melting points.  
 D Graphite conducts electricity, whereas diamond does not.

5070/11/M/J/15/Q5

- 23 Which molecule contains **three** shared pairs of electrons between two of its atoms?

- A  $\text{CO}_2$       B  $\text{C}_2\text{H}_4$       C  $\text{H}_2\text{O}$       D  $\text{N}_2$

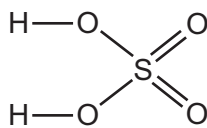
5070/12/M/J/15/Q3

- 24 Which molecules all contain one or more double covalent bonds?

- A chlorine, nitrogen and methane  
 B chlorine, oxygen and ethene  
 C oxygen, hydrogen chloride and ethene  
 D oxygen, carbon dioxide and ethene

5070/11/O/N/15/Q9

- 25 A molecule of sulfuric acid has the structural formula shown.



How many electrons are involved in forming all the covalent bonds in one molecule?

- A 6                      B 8                      C 12                      D 16

5070/11/O/N/15/Q21

- 26 Which statement about graphite is **not** correct?

- A It burns to form carbon dioxide.                      C It is a giant molecular substance.  
B It is a carbon compound.                      D It is used as a lubricant.

5070/11/M/J/15/Q4

- 27 A particle contains 34 protons, 45 neutrons and 36 electrons.

Which symbol is correct for this particle?

- A  ${}_{34}^{79}\text{Se}$                       B  ${}_{34}^{79}\text{Se}^{-}$                       C  ${}_{34}^{79}\text{Se}^{2-}$                       D  ${}_{34}^{79}\text{Se}^{2+}$

5070/11/O/N/15/Q8

- 28 An oxygen atom contains 8 electrons, 8 protons and 10 neutrons.

What is the nucleon number of this atom?

- A 8                      B 10                      C 16                      D 18

5070/12/O/N/15/Q6

- 29 The following data may refer to the atom or to the ion of the same element.

- electronic configuration 2,8,8
- nucleon number 40
- proton number 20

Which element is described by these data?

- A argon    C chlorine  
B calcium    D neon

5070/11/O/N/14/Q5

- 30 The table contains information on the structure of four particles.

particle	proton number	number of protons	number of neutrons	number of electrons
Mg	12	12	W	12
Mg <sup>2+</sup>	12	12	12	X
F	Y	9	10	9
F <sup>-</sup>	9	9	10	Z

What are the values of W, X, Y and Z in the table above?

	W	X	Y	Z
<b>A</b>	10	12	9	10
<b>B</b>	12	10	9	10
<b>C</b>	12	10	10	9
<b>D</b>	12	12	10	9

5070/12/M/J/14/Q6

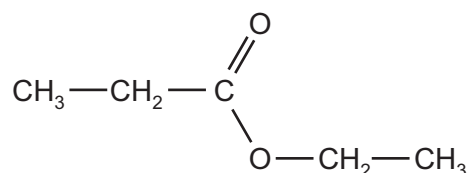
- 31 An ion X
- <sup>+</sup>
- has 23 nucleons and 10 electrons.

What does the nucleus of X contain?

	protons	neutrons
<b>A</b>	9	14
<b>B</b>	10	13
<b>C</b>	11	12
<b>D</b>	13	10

5070/12/M/J/14/Q9

- 32 The diagram shows the molecule ethyl propanoate.



Consider **all** the electrons in a molecule of ethyl propanoate.  
How many electrons **not** involved in bonding are there in the molecule?

- A** 8                      **B** 10                      **C** 18                      **D** 22

5070/11/O/N/14/Q9

33 Which molecule has only four electrons involved in covalent bonds?

A H<sub>2</sub>SB CO<sub>2</sub>C Cl<sub>2</sub>D N<sub>2</sub>

44

### Topic 2.4 Ionic Bonds

) \$+\$/%/%A/>/&&Q%#

1 Compound X is sodium iodide, NaI.

Compound Y is methyl methanoate, HCO<sub>2</sub>CH<sub>3</sub>.

At room temperature and pressure, .....1..... solid. In aqueous solution, .....2..... electricity.

Which words correctly complete gaps 1 and 2?

	1	2
<b>A</b>	both X and Y are	both X and Y conduct
<b>B</b>	both X and Y are	only X conducts
<b>C</b>	only X is	both X and Y conduct
<b>D</b>	only X is	only X conducts

5070/12/M/J/22/Q9

2 Which statement about ionic compounds is correct?

- A** They are all solids at room temperature.
- B** They all conduct electricity at room temperature.
- C** They are all soluble in water.
- D** They all have strong intermolecular forces.

5070/11/M/J/22/Q9

3 A piece of magnesium reacts with dilute hydrochloric acid.

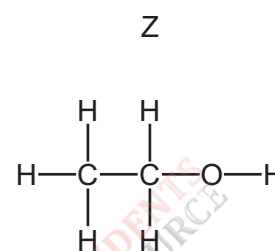
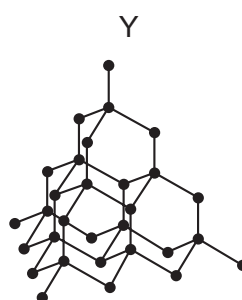
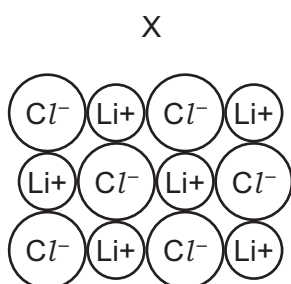
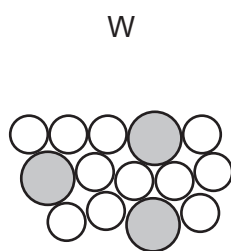
The resulting solution is then evaporated leaving a solid residue of magnesium chloride.

Which statement is correct?

- A** A covalent solid is formed in this process.
- B** Each chlorine atom gains one electron in this process.
- C** Each magnesium atom loses only one electron in this process.
- D** Molecules of an element are formed during the reaction.

) \$+\$/%/%A/>/&&Q,

4 Which statement about the substances, at room temperature and pressure, is correct?



- A** W and X conduct electricity.
- B** W and Y are elements.
- C** X and Z dissolve in water.
- D** Y and Z have low melting points.