



Shenzhen College of International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME							
CHEMISTRY CLASS		CANDIDATE NUMBER					

G1 End of Semester 1

DURATION: 80 mins

Section A: Multiple Choice questions: You should complete your answers on the MCQ answer sheet provided. **25 marks**

Section B: Short answer questions: You should complete your answers in the space provided. **37 marks.**

Section C: Alternative to practical: You should complete your answers in the space provided. **10 marks.**

There is a total of **72 marks** for this paper.

The Periodic Table of Elements is found on **page 18** of this document.

Answer **all** questions.

Electronic calculators may be used.

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 of your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

For examiners use	
Total	

Section A: Multiple Choice questions. You should complete your answers on the MCQ answer sheet.

1.

Four physical changes are listed.

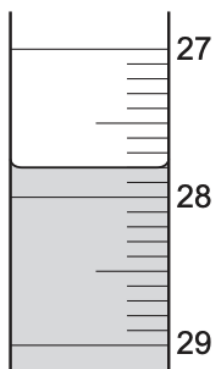
- 1 condensation
- 2 evaporation
- 3 freezing
- 4 sublimation

In which changes do the particles move further apart?

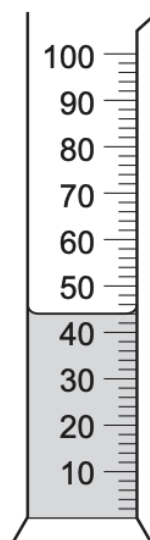
- A** 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

2.

The diagram shows liquid in a burette and in a measuring cylinder.



burette



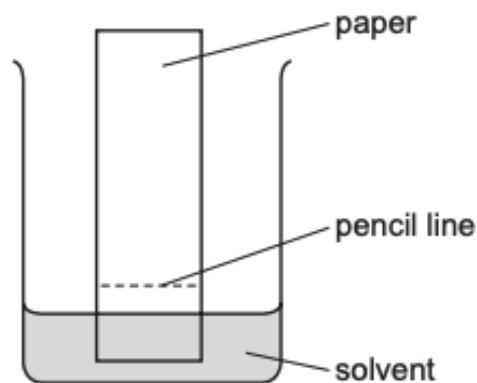
measuring cylinder

Which row shows the readings for the burette and the measuring cylinder?

	burette	measuring cylinder
A	27.8	42
B	27.8	44
C	28.2	42
D	28.2	44

3.

A student is investigating a coloured mixture using chromatography.

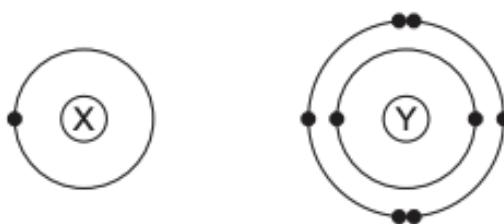


Where should the student place the coloured mixture?

- A** in the solvent
- B** just above the pencil line
- C** just below the pencil line
- D** on the pencil line

4.

The electronic structures of atoms X and Y are shown.



X and Y form a covalent compound.

What is its formula?

- A** X_2Y
- B** XY
- C** XY_2
- D** XY_6

5.

Which element is a transition metal?

	melting point in $^{\circ}\text{C}$	density in g/cm^3	colour of oxide
A	98	1.0	white
B	328	11.3	yellow
C	651	1.7	white
D	1240	7.4	black

6.

Substance L melts at -7°C and is a brown liquid at room temperature.

Which temperature is the boiling point of pure L?

- A** -77°C
- B** -7°C to $+7^{\circ}\text{C}$
- C** 59°C
- D** 107°C to 117°C

7.

Which statement about graphite and diamond is correct?

- A** Diamond has a high melting point but graphite does not.
- B** Graphite and diamond both conduct electricity.
- C** Graphite and diamond both have giant structures.
- D** Graphite is ionic and diamond is covalent.

8.

A substance dissolves in water to form a colourless solution. This solution reacts with aqueous silver nitrate in the presence of dilute nitric acid to give a yellow precipitate.

What is the possible identity of the substance?

- A** calcium iodide
- B** copper(II) chloride
- C** iron(II) iodide
- D** sodium chloride

9.

An element with a high melting point forms an oxide that is gaseous at room temperature.

Which type of structure or bonding is present in the element?

- A** giant covalent
- B** ionic
- C** metallic
- D** simple molecular

10.

One atom of element X and two atoms of element Y react to form an ionic compound. Element X forms a positive ion.

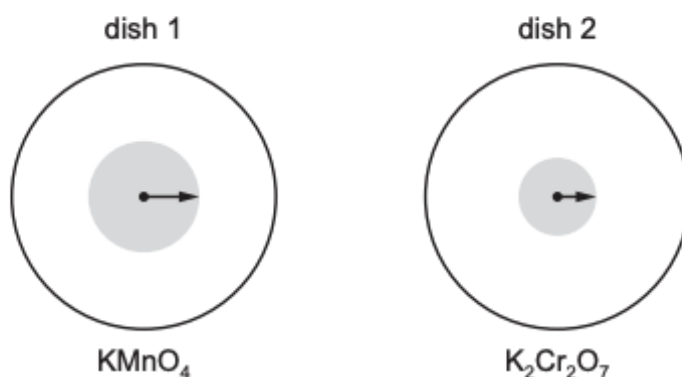
Which elements could X and Y be?

	X	Y
A	calcium	chlorine
B	calcium	oxygen
C	sodium	chlorine
D	sodium	oxygen

11.

Small crystals of purple KMnO_4 ($M_r = 158$) and orange $\text{K}_2\text{Cr}_2\text{O}_7$ ($M_r = 294$) were placed at the centres of separate petri dishes filled with agar jelly. They were left to stand under the same physical conditions.

After some time, the colour of each substance had spread out as shown.



The lengths of the arrows indicate the relative distances travelled by particles of each substance.

Which statement is correct?

- A** Diffusion is faster in dish 1 because the mass of the particles is greater.
- B** Diffusion is faster in dish 2 because the mass of the particles is greater.
- C** Diffusion is slower in dish 1 because the mass of the particles is smaller.
- D** Diffusion is slower in dish 2 because the mass of the particles is greater.

12.

Which molecule has only four electrons involved in covalent bonds?

- A** H_2S
- B** CO_2
- C** Cl_2
- D** N_2

13.

Four substances are heated gently. The temperatures at which they start and finish melting are recorded.

substance	temperature	
	start melting /°C	finish melting /°C
1	117	117
2	0	0
3	36	40
4	101	105

Which statement about the substances is correct?

- A** Substance 1 is the only pure substance.
- B** Substance 3 and substance 4 are impure.
- C** Substance 4 is water.
- D** They are all solids at room temperature.

14.

Which particle contains the greatest number of electrons?

- A** Mg^{2+}
- B** N^{3-}
- C** Ne
- D** S^{2-}

15.

What is the correct sequence for obtaining pure salt from a mixture of sand and salt?

- A** add water, evaporate
- B** add water, filter
- C** add water, filter, evaporate
- D** filter, add water, evaporate

16.

Which statement describes ionic bonding?

- A** a lattice of ions in a sea of electrons
- B** electrostatic attraction between oppositely charged ions
- C** the sharing of electrons between atoms to gain a noble gas configuration
- D** the transfer of electrons from atoms of a non-metal to the atoms of a metal

17.

Why does ammonia gas diffuse faster than hydrogen chloride gas?

- A** Ammonia has a higher boiling point than hydrogen chloride.
- B** Ammonia is a base, hydrogen chloride is an acid.
- C** The ammonia molecule contains more atoms than a hydrogen chloride molecule.
- D** The relative molecular mass of ammonia is smaller than that of hydrogen chloride.

18.

Which statement explains why the chemical properties of sodium and potassium are similar?

- A** They are in the same group of the Periodic Table.
- B** They are in the same period of the Periodic Table.
- C** They are soft and can be cut with a knife.
- D** They have similar melting points.

19.

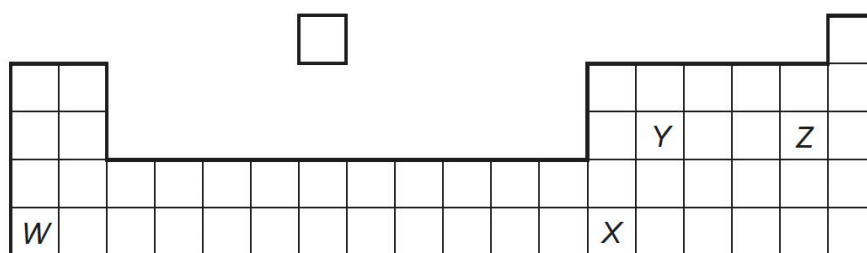
Carbon and silicon are both in Group IV of the Periodic Table, but at room temperature CO_2 is a gas whereas SiO_2 is a solid.

Which statement explains this?

- A** Covalent bonding is weaker in CO_2 .
- B** Covalent bonds in CO_2 are double bonds and in SiO_2 the covalent bonds are single bonds.
- C** CO_2 is a covalent compound and SiO_2 is ionic.
- D** CO_2 is a simple covalent molecule and SiO_2 is a macromolecule.

20.

The diagram shows an outline of part of the Periodic Table.



Which statement is **not** correct?

- A** The melting point of *W* is lower than that of *Z*.
- B** *W* and *Z* could react together and form a compound, *WZ*.
- C** *X* could form an oxide, X_2O_3 .
- D** *Y* could form an oxide, YO_2 .

21.

Atoms of elements X and Y have the electron configurations 2,5 and 2,8,5 respectively.

Which deduction about these elements can be made from this information?

- A** The atoms are isomers.
- B** The atoms are isotopes.
- C** The elements are in the same group of the Periodic Table.
- D** The elements are in the same period of the Periodic Table.

22.

Which substance has metallic bonding?

	conducts electricity		state of substance formed on reaction with oxygen
	when solid	when liquid	
A	✓	✓	solid
B	✓	✓	gas
C	x	✓	no reaction
D	x	x	solid

23.

Which row shows how the hydrogen ion concentration and pH of ethanoic acid compare to those of hydrochloric acid of the same concentration?

	ethanoic acid compared to hydrochloric acid	
	hydrogen ion concentration	pH
A	higher	higher
B	higher	lower
C	lower	higher
D	lower	lower

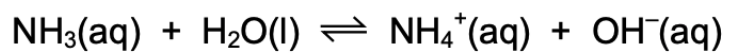
24.

Which statement about oxides is correct?

- A** A solution of magnesium oxide has a pH less than pH 7.
- B** A solution of sulfur dioxide has a pH greater than pH 7.
- C** Magnesium oxide reacts with nitric acid to make a salt.
- D** Sulfur dioxide reacts with hydrochloric acid to make a salt.

25.

The equation represents an equilibrium in aqueous ammonia.



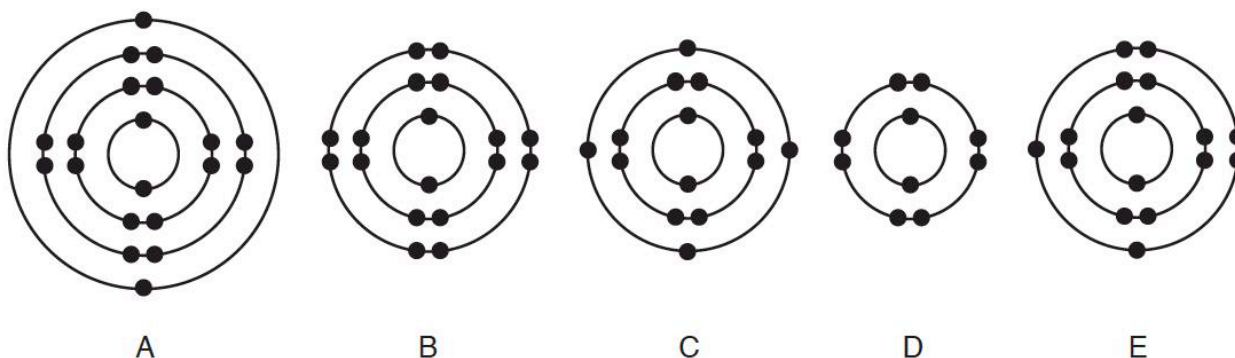
How does aqueous ammonia behave in this reaction?

- A** as a strong acid
- B** as a strong base
- C** as a weak acid
- D** as a weak base

Section B: Short answer questions. You should complete your answers in the space provided

1.

The electronic configurations of five atoms are shown.



(a) Which electronic configuration represents each of the following descriptions?

Each electronic configuration may be used once, more than once or not at all.

(i) a sulfur atom

.....[1]

(ii) a metal atom

.....[1]

(iii) an atom with a proton number of 14

.....[1]

(iv) an atom of a noble gas with three occupied electron shells

.....[1]

(v) an atom which forms a noble gas electronic configuration when it loses two electrons

.....[1]

(b) The element germanium has five naturally occurring isotopes.

An isotope of germanium is represented by the symbol shown.



(i) What is the meaning of the term *isotopes*?

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

(ii) Deduce the number of neutrons in one atom of this isotope of germanium.

.....[1]

[Total: 7]

2.

The Periodic Table is an arrangement of elements in groups and periods.

(a) What are the factors that determine the position of an element in the Periodic Table?

.....
.....
.....
.....[2]

(b) Phosphorus is an element in Group V of the Periodic Table.

Deduce the electronic configuration of a phosphide ion, P^{3-} .

.....[1]

(c) Phosphine, PH_3 , is a covalent compound.

(i) Draw a 'dot-and-cross' diagram of phosphine.

Only draw the outer shell electrons.

[2]

(ii) Some properties of phosphine are listed.

- gas at room temperature
- almost insoluble in water
- reacts with hydrogen chloride
- has no effect on litmus paper
- decomposes to form hydrogen and phosphorus only when warmed gently

Describe two ways in which the properties of ammonia are **different** from those of phosphine.

1.

2.

[2]

(iv) Describe and explain the difference in the rate of diffusion of the gases ammonia and phosphine at the same temperature and pressure.

.....

.....

.....[1]

(v) Phosphine burns in oxygen to form phosphorus(V) oxide.

Is phosphorus(V) oxide an acidic, basic or amphoteric oxide? Give a reason for your answer.

.....

.....[1]

[Total: 10]

3 (a) Match the following pH values to the solutions given below.

1 3 7 10 13

The solutions all have the same concentration.

solution	pH
aqueous ammonia, a weak base	
dilute hydrochloric acid, a strong acid	
aqueous sodium hydroxide, a strong base	
aqueous sodium chloride, a salt	
dilute ethanoic acid, a weak acid	

[5]

(b) Explain why solutions of hydrochloric acid and ethanoic acid with the same concentration, in mol / dm³, have a different pH.

.....

 [2]

(c) Measuring pH is one way of distinguishing between a strong acid and a weak acid. Describe another method.

method

 results
 [2]

[Total: 9]

4.

The table shows the melting points, boiling points and electrical properties of five substances, A to E.

substance	melting point / °C	boiling point / °C	electrical conductivity of solid	electrical conductivity of liquid
A	-7	59	poor	poor
B	1083	2567	good	good
C	755	1387	poor	good
D	43	181	poor	poor
E	1607	2227	poor	poor

Choose a substance from the table above to match each of the following descriptions. A substance may be used once, more than once or not at all. Justify each choice with evidence from the table.

One has been completed as an example.

This substance is covalent and is a solid at room temperature (25 °C). **D**

evidence *Its melting point is above room temperature. It has a low melting point and it does not conduct as a liquid, so it is covalent.*

(a) This substance has a giant covalent structure.

evidence [3]

(b) This substance is a metal.

evidence [2]

(c) This substance is a liquid at room temperature (25 °C).

evidence

..... [3]

(d) This substance is an ionic solid.

evidence

..... [3]

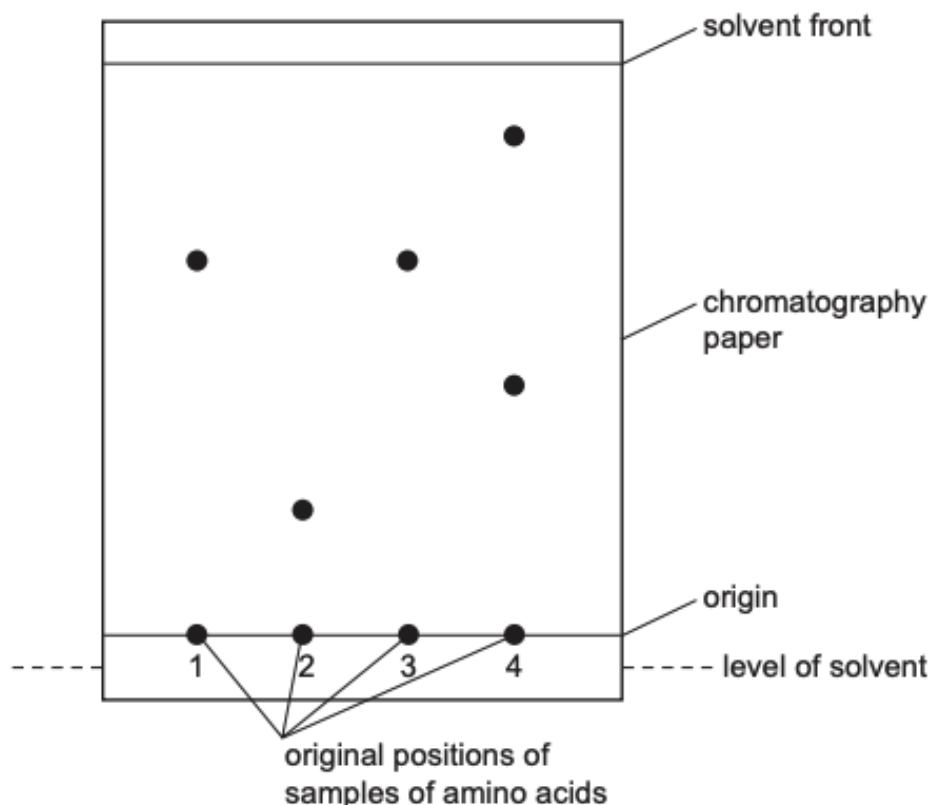
[Total 11]

Section C: Alternative to practical: You should complete your answers in the space provided.

1.

Chromatography can be used to identify amino acids from a sample of protein.

The diagram shows the chromatogram obtained when four samples of amino acids were analysed. The paper was sprayed with ninhydrin.



(a) Why is the origin line drawn in pencil?

..... [1]

(b) Which amino acids could possibly be the same?

..... [1]

(c) Which amino acid sample contains more than one amino acid? Explain your answer.

sample

explanation

..... [2]

(d) Suggest why it is necessary to spray the chromatogram with ninhydrin.

..... [1]

[Total: 5]

2.

A list of techniques used to separate mixtures is given below.

**fractional
distillation**

**simple
distillation**

crystallization

filtration

diffusion

From the list choose the most suitable technique to separate the following.

water from aqueous copper(II) sulphate

helium from a mixture of helium and argon

copper(II) sulphate from aqueous copper(II) sulphate

ethanol from aqueous ethanol

barium sulphate from a mixture of water and barium sulphate [5]

[Total: 5]

Group

lanthanoids	57	La lanthanum 139	58	Ce cerium 140	59	Pr praseodymium 141	60	Nd neodymium 144	61	Pm promethium —	62	Sm samarium 150	63	Eu europium 152	64	Gd gadolinium 157	65	Tb terbium 159	66	Dy dysprosium 163	67	Ho holmium 165	68	Er erbium 167	69	Tm thulium 169	70	Yb ytterbium 173	71	Lu lutetium 175	
	actinoids	89	Ac actinium —	90	Th thorium 232	91	Pa protactinium 231	92	U uranium 238	93	Np neptunium —	94	Pu plutonium —	95	Am americium —	96	Cm curium —	97	Bk berkelium —	98	Cf californium —	99	Es einsteinium —	100	Fm fermium —	101	Md mendelevium —	102	No nobelium —	103	Lr lawrencium —

19

1.

5070/21

Cambridge O Level – Mark Scheme
PUBLISHED

October/November 2018

Question	Answer	Marks
1(a)(i)	C	1
1(a)(ii)	D	1
1(a)(iii)	B	1
1(a)(iv)	A	1
1(a)(v)	D	1
1(b)(i)	20	1
1(b)(ii)	molecule containing two atoms	1

2.

Question	Answer	Marks
5(a)	Any two from: - number of protons / number of electrons (1) - number of electrons in outer shell (1) - number of (electron) shells (1)	2
5(b)	2.8.8	1
5(c)(i)	correct dot and cross diagram showing 3 pairs of bonding electrons and two non-bonding electrons (2) If two marks not scored, award one mark for one pair of bonding electrons in each of the three overlap areas	2

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Page 6 of 10

5070/22

Cambridge O Level – Mark Scheme
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Question	Answer	Marks
5(c)(ii)	Any two from: - ammonia is soluble (in water) (1) - ammonia turns (damp) red litmus blue (1) - ammonia does not decompose (when warmed gently) (1)	2
5(c)(iii)	$2\text{PH}_3 \rightarrow 2\text{P} + 3\text{H}_2$	1
5(c)(iv)	phosphine diffuses more slowly because it has higher (relative) molecular mass / ammonia diffuses more quickly because it has a lower (relative) molecular mass	1
5(c)(v)	acidic because it is a non-metal oxide / acidic because phosphorus is a non-metal	1

3.

- 3 (a) Match the following pH values to the solutions given below.

1 3 7 10 13

The solutions all have the same concentration.

solution	pH	
aqueous ammonia, weak base	10	
dilute hydrochloric acid, a strong acid	1	
aqueous sodium hydroxide, a strong base	13	
aqueous sodium chloride, a salt	7	
dilute ethanoic acid, a weak acid	3	[5]

- (b) Hydrochloric acid strong acid **or** ethanoic acid weak acid [1]
OR: hydrochloric acid completely ionised **or** ethanoic acid partially ionised
 hydrochloric acid greater concentration of/more H^+ ions (than ethanoic acid) [1]

- (c) Rate of reaction with Ca, Mg, Zn, Fe [1]
 Strong (hydrochloric) acid bubbles faster **or** more bubbles **or** dissolves faster [1]
OR: rate of reaction with (metal) carbonate [1]
 strong (hydrochloric) acid faster **or** more bubbles **or** dissolves faster (only if carbonate insoluble) [1]
OR: electrical conductivity [1]
 strong (hydrochloric) acid better conductor [1]

[Total: 9]

4.

Question	Answer	Marks	Guidance
1(a)	E; high melting point/mp/mpt OR high boiling point/bp/bpt; poor/non conductor (when liquid and/or solid);	3	I mpt/bpt above room temp
(b)	B; (good) conductor when <u>solid</u> (and liquid);	2	A (good) conductor in any state/both states I high melting point/boiling point R low melting point/boiling point
(c)	A; melting point/ $-7^{\circ}C$ is below room temperature/ $25^{\circ}C$ /RTP ora; boiling point/ $59^{\circ}C$ is above room temperature/ $25^{\circ}C$ /RTP ora;	3	I low melting point/boiling point/conductivity 25 ($^{\circ}C$)/room temperature/RTP is in between $-7^{\circ}C$ and $59^{\circ}C$ OR 25 ($^{\circ}C$)/room temperature/RTP is between mpt and bpt would both score the 2 evidence marks
(d)	C; high melting point/mp/mpt OR high boiling point/bp/bpt; BOTH poor/non conductor when solid and good conductor when liquid OR molten/only conduct when liquid;	3	A melting point and boiling point both above room temp/ $25^{\circ}C$ /RTP I conducts when aqueous or in solution I conducts in liquid due to free electrons

Section C:

1.

(a) does not dissolve in solvent / interfere with results owtte (1) [1]

(b) 1 and 3 (1) [1]

(c) sample 4 (1)
two spots present (1) [2]

(d) to show position of the acids / spots (1) [1]

[Total: 5]

2. Simple Distillation

Diffusion

Crystallization

Fractional Distillation

Filtration