

RIVER VALLEY HIGH SCHOOL YEAR 6 PRELIMINARY EXAMINATION II

CANDIDATE NAME					
CLASS	6				
CENTRE NUMBER	S 3 0 4 4	INDEX NUMBER	0 0		
H2 CHEMISTRY 9729/01					
Paper 1 Multiple	Choice		2 ⁻	1 Sep 2017	
				1 hour	
Additional Mater	ials: Multiple Choice Answer Sheet				

Data Booklet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid. Write your name, class and index number on the Optical Answer Sheet in the spaces provided.

There are **thirty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.

Choose the one you consider correct and record your choice in **soft pencil** on the Optical Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet. The use of an approved scientific calculator is expected, where appropriate.

This document consists of **16** printed pages and **0** blank pages.

For each question there are four possible answers, **A**, **B**, **C** and **D**. Choose the **one** you consider to be correct.

1 Use of the Data Booklet is relevant to this question.

At room temperature and pressure, a sample of 2 dm³ of polluted air was passed through limewater so that all the carbon dioxide present was precipitated as calcium carbonate. The mass of calcium carbonate formed was 0.05 g.

What is the percentage, by volume, of carbon dioxide in the air sample?

Α	0.30%	В	0.57%
С	0.60%	D	1.20%

2 When $Tl^+(aq)$ reacts with $VO_3^-(aq)$, $Tl^{3+}(aq)$ and $V^{2+}(aq)$ are formed.

Assuming the reaction goes to completion, how many moles of $Tl^+(aq)$ and $VO_3^-(aq)$ would result in a mixture containing equal number of moles of $VO_3^-(aq)$ and $V^{2+}(aq)$ once the reaction had taken place?

	Moles of Tl ⁺ (aq) Moles of VO ₃ ⁻ (aq)		
Α	1	2	
В	1	3	
С	2	3	
D	3	4	

- **3** Which of the following statements about the carbonate ion, CO_3^{2-} , are correct?
 - 1 The carbon atom is sp²-hybridised.
 - 2 The carbon in CO_3^{2-} has an octet electronic configuration.
 - 3 It has the same bond angle as the nitrate ion, NO_3^{-} .
 - A 1 only
 - **B** 1 and 2 only
 - **C** 2 and 3 only
 - **D** 1, 2 and 3 only

4 The diagram represents the melting points of four consecutive elements in the third period of the Periodic Table.



The sketches below represent another two properties, *m* and *n*, of the elements.



What are the properties *m* and *n*?

	Property <i>m</i>	Property n	
Α	third ionisation energy	electronegativity	
В	number of valence electrons	boiling point	
С	ionic radius	effective nuclear charge	
D	electrical conductivity	atomic radius	

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5 Use of the Data Booklet is relevant to this question.

Species containing one or more unpaired electrons are said to be paramagnetic as they can be attracted by an external magnetic field.

Which of the following species are paramagnetic?

1 Cr³⁺

- 2 Fe²⁺
- 3 Cu⁺
- A 1 only
- **B** 1 and 2 only
- C 1 and 3 only
- D 2 and 3 only
- 6 Which pair of compounds meets the criteria below?
 - The first compound has a larger bond angle than the second compound.
 - The second compound is more polar than the first compound.
 - **A** CO₂, BC l_3 **B** IC l_2 , C l_2 **C** HCN, SO₃ **D** CO₂, NC l_3
- 7 Flask X contains 1 dm³ of helium at a pressure of 2 kPa and flask Y contains 2 dm³ of neon at a pressure of 1 kPa.

If the flasks are connected at constant temperature, what is the final pressure?

A 1.00 kPa B 1.33 kPa C 1.67 kPa D 2.00 kPa

8 When water is stirred with glucose, strong hydrogen bonds are initially formed between glucose molecules and water molecules, but as more water is added, these hydrogen bonds are broken.

Which graph best represents the observed temperature changes?



9 Use of the Data Booklet is relevant to this question.

A student dissolved 8.4 g of sodium fluoride in 250 g of water.

Given the following thermodynamic data,

Lattice energy of NaF = -918 kJ mol⁻¹

Enthalpy change of hydration of $F^- = -457$ kJ mol⁻¹

Enthalpy change of hydration of Na⁺ = -390 kJ mol⁻¹

What would be the initial temperature of the water if the final temperature of the solution is 20.00 °C?

Assume that the specific heat capacity of water is 4.2 J $g^{-1} K^{-1}$.

A 6.48 °C **B** 33.08 °C **C** 33.52 °C **D** 47.62 °C

10 Ammonia gas and hydrogen chloride gas react to form ammonium chloride as shown in the equation below:

 $NH_3(g) + HCl(g) \rightarrow NH_4Cl(s)$ $\Delta H = -176 \text{ kJ mol}^{-1}$ The standard entropy change of this reaction is -284 J K⁻¹ mol⁻¹. Which of the following statements is **not** correct?

- A The reaction is spontaneous at 500 K.
- **B** There is an increase in order due to the formation of a solid from gases.
- **C** The reaction becomes non-spontaneous at temperatures higher than 620 K.
- **D** Under standard conditions, $\Delta G = +8.4 \times 10^7 \text{ J mol}^{-1}$.
- 11 The graph below shows how the fraction of a substance, **X**, in an equilibrium mixture varies with temperature at pressures of 2×10^7 Pa and 5×10^7 Pa.



Which underlined compound represents X?

- **A** $2N_2(g) + 6\underline{H_2O}(g) \rightleftharpoons 4NH_3(g) + 3O_2(g) \Delta H = +1267 \text{ kJ mol}^{-1}$
- **B** $C(s) + H_2O(g) \rightleftharpoons H_2(g) + \underline{CO}(g)$ $\Delta H = +131 \text{ kJ mol}^{-1}$

C
$$2SO_2(g) + O_2(g) \rightleftharpoons 2\underline{SO_3}(g)$$
 $\Delta H = -197 \text{ kJ mol}^{-1}$

D
$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$
 $\Delta H = -92 \text{ kJ mol}^{-1}$

12 The solubility products of some sparingly soluble silver compounds are shown below. Which compound, in saturated solution, contains the lowest concentration of silver ions?

	Compound	Solubility Product
Α	silver arsenate(V), Ag ₃ AsO ₄	1.0 × 10 ⁻²² mol ⁴ dm ⁻¹²
в	silver bromide, AgBr	5.0 × 10 ⁻¹³ mol ² dm ⁻⁶
С	silver carbonate, Ag ₂ CO ₃	8.1 × 10 ⁻¹² mol ³ dm ⁻⁹
D	silver chromate(VI), Ag ₂ CrO ₄	1.1 × 10 ⁻¹² mol ³ dm ⁻⁹

13 The kinetics of the reaction between iodide and peroxodisulfate can be investigated by varying the volume of the reactants used. The two reactants are mixed in the presence of a known amount of Na₂S₂O₃ and a little starch. The time taken for an intense blue colour to be observed is then determined.

	Volume used/cm ³				
Experiment	1.0 mol dm ⁻³ KI	0.040 mol dm ⁻³ Na₂S₂O ₈	H ₂ O	t/s	
1	10.0	5.0	25.0	170	
2	15.0	5.0	20.0	113	
3	15.0	10.0	15.0	57	
4	20.0	20.0	0.0	х	

What is the value of x?

Α	21	В	28	С	85	D	63
		_		-		_	

14 L, M and N react to form P and Q as shown.

 $L + M + N \rightarrow P + Q$

The rate equation for this reaction is rate = $k[\mathbf{M}][\mathbf{N}]$.

Which of the following graphs is correct of the above reaction, when N is in excess?



15 The silver halides, AgC*l* and AgBr, are both sparingly soluble in water. AgC*l* dissolves in dilute NH₃(aq) but AgBr can only dissolve in concentrated NH₃.

Which statement helps to explain this observation?

- **A** The complex ion in $[Ag(NH_3)_2]Br$ is more stable than the complex ion in $[Ag(NH_3)_2]Cl$.
- **B** A higher concentration of NH_3 ligand is required to form $[Ag(NH_3)_2]Br$.
- **C** The lattice energy of AgBr(s) is numerically larger than that of AgC*l*(s).
- **D** The solubility product of AgBr(s) is smaller than that of AgCl(s).

16 Use of the Data Booklet is relevant to this question.

Hydroxyapatite, a basic calcium phosphate, Ca(OH)₂.3Ca₃(PO₄)₂, is the mineral found in bone.

Older people may lose calcium ions from the hydroxyapatite, weakening the bone structure. For such cases, strontium salts are administered to strengthen the bone. The strontium ions replace the lost calcium ions in the hydroxyapatite.

Which statements are correct?

- 1 Strontium ions have similar ionic radii as calcium ions and so may easily replace them in hydroxyapatite.
- 2 Strontium hydroxide is more soluble than calcium hydroxide and so will precipitate better in the bone structure.
- **3** There is ionic and covalent bonding in hydroxyapatite which gives it strength.
- A 1 only
- **B** 2 only
- **C** 1 and 3 only
- **D** 1, 2 and 3 only
- **17** Given weighed samples of the same mixture of magnesium carbonate and barium carbonate, which method will **not** allow the mole fraction of magnesium carbonate in the mixture to be estimated?
 - A Add a known volume of 0.1 mol dm⁻³ HNO₃(aq) in excess and back titrate the excess acid.
 - **B** Add an excess of HC*l*(aq) followed by an excess of H₂SO₄(aq); filter, dry and weigh the precipitate.
 - **C** Add an excess of HNO₃(aq) and measure, at room temperature and pressure, the volume of CO₂ liberated.
 - **D** Heat the mixture at 170°C for 10 minutes. Cool and weigh the mass of residue.

18 When aqueous ammonia is added to a solution containing hexaaquairon(III) ions, [Fe(H₂O)₆]³⁺, a red-brown precipitate is formed which does not dissolve when excess ammonia is added.

What is the role of ammonia molecules in this reaction?

- A Brønsted-Lowry base
- **B** Lewis acid
- **C** Ligand
- **D** Reducing agent
- **19** Adding concentrated HC*l*(aq) to CuSO₄(aq) causes the colour of the solution to change from blue to yellow.

Which row best explains this observation? You are given that in the visible spectrum, red light has the lowest energy and violet light has the highest energy.

	Number of d-electrons around copper	Energy gap between the d-orbitals	
Α	Remains the same	Increase	
В	Remains the same	Decrease	
С	Changes	Increase	
D	Changes	Decrease	

20 Scandium, Sc, is the first of the d-block elements in the Periodic Table.Which properties of scandium are consistent with this fact?

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- 1 Scandium has an ionic chloride.
- 2 Scandium readily forms oxidation states of +3 and +4.
- **3** Compounds containing Sc^{3+} are coloured.
- A 1 only
- **B** 2 only
- **C** 1 and 2 only
- D 2 and 3 only

21 Alkynes are a series of non-cyclic hydrocarbons with the general formula, C_nH_{2n-2} containing one carbon-carbon triple bond per molecule.

How many alkynes with 6 carbon atoms satisfies the above formula?

- **A** 5
- **B** 6
- **C** 7
- **D** 8
- **22** During the preparation of many organic compounds, by-products are formed. This usually occurs because the reagents can react in more than one way, depending on the conditions used, or because the products formed may react with the reactants.

2-bromobutane may be prepared by slowly adding concentrated sulfuric acid to sodium bromide to form hydrogen bromide which reacts with butan-2-ol. The reaction mixture is kept cool to optimise the reaction yield.

 $CH_{3}CH(OH)CH_{2}CH_{3} + HBr \rightarrow CH_{3}CH(Br)CH_{2}CH_{3} + H_{2}O$

What could be a by-product of this reaction if the temperature is allowed to rise?

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- 1 CH₂=CHCH₂CH₃
- 2 CH₂BrCH₂CH₂CH₃
- 3 CH₃CBr₂CH₂CH₃
- A 1 only
- B 1 and 2 only
- C 2 and 3 only
- **D** 1, 2 and 3 only

- 23 Which method is able to separate benzene from a mixture of benzene and an amine?
 - A Extracting the amine with ethanol
 - B Nitrating the benzene with a nitrating agent to precipitate the solid
 - **C** Shaking the mixture with dilute aqueous acid
 - **D** Extracting the benzene with hexane
- **24** Deuterium is an isotope of hydrogen, ${}_{1}^{2}H$.

Which compound can be formed by the addition of D_2 to another molecule, in the presence of platinum catalyst?

1 CH₃CD₂ND₂



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

25 The diagram shows a reaction.



What could be the final products, P?



- 26 Which salt will give a solution with the lowest pH in aqueous solution?
 - **A** $C_2H_5NH_3^+Cl^-$
 - **B** NH₄⁺C l^{-}
 - $C \quad C_6H_5NH_3^+Cl^-$
 - **D** K⁺C*l*⁻



14

27 Which transformations involve a nucleophile?

Use of the Data Booklet is relevant to Questions 28 - 30.

28 When a dilute sulfate solution of a metal **J** is electrolysed, the metal **J** and a diatomic gas **K** are produced at the cathode and the anode respectively in the molar ratio 2:1.

In another experiment, the same quantity of electricity is used to electrolyse a saturated sodium chloride solution and a gas L is evolved at the anode.

What is the molar ratio of **J** : **K** : **L**?

A 2:1:1 B 2:1:2 C 4:2:1 D 4:
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29 Iron(II) salts are often used as a dietary supplement to help cure some forms of anaemia. The amount of iron in such a pill may be estimated by titration with KMnO₄ (aq).

A dietary supplement pill was dissolved in 10 cm³ of dilute sulfuric acid and titrated using 0.0200 mol dm⁻³ KMnO₄. The E_{cell} was measured against a standard hydrogen electrode and the following graph was obtained.



Which of the following lists appropriate approximate E values, in volts, for the points **P** and **Y**?

	Point P	Point Y
Α	1.52	1.96
В	0.77	1.52
С	0.75	0.77
D	0.75	1.52

30 Use of the Data Booklet is relevant to this question.

An electrolytic cell containing Mn^{2+} and another metal ion, Y^{3+} , is connected to Mn and Pt electrodes. The reactions that took place are

$$Mn \rightarrow Mn^{2+} + 2e^{-}$$
$$\mathbf{Y}^{3+} + 3e^{-} \rightarrow \mathbf{Y}$$

Which of the following statements are correct?

- 1 The Mn electrode is the anode.
- 2 A possible identity of **Y** is aluminium.
- **3** The number of moles of **Y** deposited is 1.5 times the number of moles of Mn²⁺ formed.
- A 1 only
- **B** 2 only
- C 1 and 2 only
- D 1 and 3 only

Answers to Paper 1

1	С	11	В	21	С
2	D	12	В	22	В
3	D	13	А	23	С
4	А	14	В	24	С
5	В	15	D	25	А
6	D	16	С	26	С
7	В	17	D	27	D
8	С	18	А	28	В
9	С	19	А	29	В
10	D	20	A	30	A