Girraween High School

Student Number

2019 **YEAR 11 YEARLY EXAMINATION**

Chemistry

General Instructions

- Reading time – 5 minutes
- Working time – 2 hours
- Write using black pen
- Draw diagrams using pencil
- Calculators approved by NESA may be used

Total Marks: 70

Section I – 15 marks (pages 1 – 4)

- Attempt questions 1–15
- Allow about 35 minutes for this part

Section II – 55 marks (pages 5 – 13)

- Attempt questions 16–28
- Allow about 1 hour and 35 minutes for this part

Section I
15 Marks

Attempt Questions 1–15
Allow about 25 minutes for this part

Use the multiple-choice answer sheet for Questions 1–15.

Select the alternative A, B, C or D that best answers the question. Fill in the response circle completely.

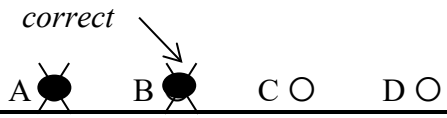
Sample 2 + 4 = (A) 2 (B) 6 (C) 8 (D) 9

A ○ B ● C ○ D ○

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A ○ B ⊗ C ○ D ○

If you change your mind and have crossed out what you consider to be the correct answer, then indicate this by writing the word *correct* and drawing an arrow as follows:



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1. Which of the following BOND arrangement always results in polar molecule.

   A. Bent
   B. Linear
   C. Tetrahedral
   D. Trigonal planar

2. Which sample contains the largest amount of oxygen atoms in mols?

   A. 0.30 mol HCOOH
   B. 0.70 mol H_2O_2
   C. 0.40 mol $KMnO_4$
   D. 0.20 mol NO_3

3. Identify the missing particle required to balance the following nuclear equation:

$$^{232}_{92}U \rightarrow ^{228}_{90}Th + _____$$

A. $^{0}_{-1}e$
B. $^{1}_{0}n$
C. $^{4}_{2}He$
D. γ

4. Which of the following options contain three species with the same electron configuration?

A. F^- , O^{2-} , K^+
B. O^{2-} , S^{2-} , Se^{2-}
C. Ar, Ca^{2+}, Cl^-
D. Mg, Na, Al

5. Which one of the following statements is correct regarding the allotropes of carbon?

A. The allotropes of carbon differ in atomic mass.
B. The allotropes of carbon have the same melting point.
C. The allotropes of carbon differ in their atomic bonding.
D. The allotropes of carbon differ in the products they form with other reagents, e.g. oxygen.

6. What volume of water must be added to 20.0 mL of 0.50 $molL^{-1}$ NaCl in order to change its concentration to 0.20 $molL^{-1}$?

A. 30.0 mL
B. 50.0 mL
C. 200 mL
D. 500 mL

7. The molar mass of anhydrous iron(III) sulfate is:

A. 151.9 g mol^{-1}
B. 335.8 g mol^{-1}
C. 344.1 g mol^{-1}
D. 399.9 g mol^{-1}

8. What is a dispersion force ?

A. An attraction arising from a shared electron pair.
B. An attraction arising from oppositely charged ions.
C. An electrostatic attraction between temporary dipoles.
D. An electrostatic attraction between permanent dipoles.

9. Which of the following statement is true for the Law of Conservation of mass.

A. Mass cannot be conserved in a chemical reaction as some is always lost.
B. The total mass of a closed system changes depending on the reaction conditions.
C. The mass of a closed system always increases as mass is gained from the surroundings.
D. The mass of the closed system cannot be changed over time. Mass cannot be created nor destroyed.

10. What is the IUPAC name of $Al(NO_3)_3$?

A. Zinc sulphate
B. Aluminium(III) nitrogen tri-oxygen
C. Aluminium nitrate
D. Aluminium nitrite

11. Which of the following properties of water cannot be explained by intermolecular forces?

A. Bent shape
B. Boiling point
C. Surface tension
D. Viscosity

12. Which one of the following would not change the initial rate of reaction between zinc and 1 M nitric acid?

A. The addition of a catalyst.
B. A change in the temperature of the reactants.
C. Breaking down the zinc into smaller particles.
D. Using double the volume of nitric acid solution.

13. Consider the information in the table below.

Metal	Reacts with water?	Reacts with steam?	Reacts with dilute acid
1	No	No	Yes
2	No	No	No
3	No	Yes	Yes
4	Yes	Yes	Yes

What is the order of reactivity of these metals, from most to least reactive?

A. 1,2,3,4
B. 2,3,4,1
C. 3,1,2,4
D. 4,3,1,2

14. A student carried out a simple experiment. He filled a balloon with 1 litre of air in the morning when the temperature was 12°C. The balloon was left in a car. In the afternoon, the temperature rose to 35°C. The pressure of air remained 100 kPa all throughout. Which one of the statements correctly describe the observations that the student made?

    A. The balloon pressure remained the same but its volume increased to about 1.1 litre.
    B. The balloon pressure decreased but its volume increased to about 1.3 litre.
    C. The balloon pressure increased and its volume increased to about 1.1 litre.
    D. The balloon pressure increased and its volume increased to about 1.3 litre.

15. Nitrogen gas and hydrogen gas are mixed in a ratio of 1 to 3 and heated in the presence of an iron catalyst. Ammonia gas is produced. The choice that best describe the reaction is:

A. The chemical equation for above reaction is $N_2(g) + 6H(g) \rightarrow 2NH_3(g)$
B. A synthesis reaction occurred in which at higher pressure, the volume of gases will decrease if temperature is kept the same.
C. Under the same conditions of temperature and pressure, the volume of reactants to one another do not bear a simple number ratio.
D. This is a synthesis reaction in which, at constant volume of the gases, the pressure of the gases is inversely proportional to their temperature.

End of Section I.

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Student Number								
Section I: Mark /15								
Section II: Mark /55								
Total Mark /70								

Chemistry
Section I – Answer Sheet

15 marks
Attempt questions 1 – 15
Allow about 25 minutes for this section

Instructions

- Write your student number at the top of this page.
- Select the alternative A, B, C or D that best answers the question and fill in the response circle completely.
- Use a blue or black pen to answer the questions.

1.	A ○	B ○	C ○	D ○
2.	A ○	B ○	C ○	D ○
3.	A ○	B ○	C ○	D ○
4.	A ○	B ○	C ○	D ○
5.	A ○	B ○	C ○	D ○
6.	A ○	B ○	C ○	D ○
7.	A ○	B ○	C ○	D ○
8.	A ○	B ○	C ○	D ○
9.	A ○	B ○	C ○	D ○
10.	A ○	B ○	C ○	D ○
11.	A ○	B ○	C ○	D ○
12.	A ○	B ○	C ○	D ○
13.	A ○	B ○	C ○	D ○
14.	A ○	B ○	C ○	D ○
15.	A ○	B ○	C ○	D ○

Examiner's Use Only		

Student Number	
Mark / 55	

Chemistry
Section II

55 marks
Attempt Questions 16 – 28
Allow about 1 hour 35 minutes for this section

Instructions

- Write your student number at the top of this page.
- Answer the questions in the spaces provided. These spaces provide guidance for the expected length of the response.
- Extra writing paper is available, please raise your hand to request more paper. If you use extra paper, clearly indicate your student number and which question you are answering.

Please turn over

Question 16 (6 marks)

4.0 g of aluminum was combusted in excess oxygen gas.

a) Write a balanced chemical equation for this reaction. **1**

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b) Calculate how many moles of aluminum reacted. **1**

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c) Calculate how many atoms of oxygen reacted. **2**

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d) Calculate the mass of the product formed. **2**

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Question 17 (2 marks)

Write the formulae of the following compounds:

a) Potassium nitrate: …… **1**

b) Iron(III) oxide: …… **1**

Question 18 (2 marks)

Write the full electronic configuration of potassium metal. **2**

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Question 19 (3 marks)

Metal *X* burns in air and forms a compound with the empirical formula X_2O.

When 0.753 g of metal burns completely, 0.907 g of X_2O forms.

a) Calculate the molar mass of *X*. **2**

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b) Identify metal *X*. **1**

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Question 20 (9 marks)

a) Define the term 'electronegativity'. **1**

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b) Explain the periodic trends in electronegativity across a period and down a group, with reference to subatomic composition. **3**

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c) Describe the structure of sodium chloride and explain why it forms this structure, with reference to its electronegativity. Provide a simple diagram to aid your answer. **3**

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d) Explain why sodium chloride conducts electricity in an aqueous state, but not when solid. **2**

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Question 21 (7 marks)

a) Calculate the molarity of a solution prepared by dissolving 0.425 g of calcium chloride in enough water and diluting it to 250.00 mL. **2**

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b) What is the concentration of the chloride ion in a) in %(w/v)? **2**

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c) If 15.0 mL of a 0.3 mol L^{-1} sodium carbonate solution is added to 100.0 mL of the solution in a), what mass of precipitate is obtained? **3**

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Question 22 (4 marks)

In an acidic solution, aqueous permanganate ions, MnO_4^-, react with aqueous iron(II) ions, Fe^{2+}, to produce a solution containing manganese(II) ions, Mn^{2+} and iron(III) ions, Fe^{3+}.

a) Write a balanced overall equation to represent the redox reaction described above. **2**

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b) Identify the species that undergoes reduction in the reaction above. **1**

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c) Use oxidation numbers to justify why the species identified in b) has undergone reduction. **1**

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Question 23 (3 marks)

An electrochemical cell is constructed by connecting the following two half-cells:

A 1.00 M $Sn(NO_3)_2$*(aq)* solution with a platinum electrode
A 1.00 M $Cu(NO_3)_2$*(aq)* solution with a copper electrode

Draw a labelled diagram of the electrochemical cell in the space below, showing: **3**
- The anode and the cathode and the contents in each of the half cells;
- The direction of electron flow in the external circuit, and the direction in which the ions flow in the salt bridge

Question 24 (5 marks)

Copper solid is placed in a beaker containing 250 mL of 1.0 M HCl.

a) Write the equations for the oxidation and reduction half reactions for this reaction. **2**

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b) Calculate the standard cell potential, E°, for this reaction, and predict the spontaneity of the reaction. **3**

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Question 25 (1 mark)

The information in the table below outline some physical properties of some elemental metals as outlined in the SI Chemical Data Book 5th Ed by Aylward & Findlay.

Metal	**First Ionisation Energy** (kJ/mol)	**Atomic Radius** (pm)	**Electronegativity** (Pauling scale)
J	502	186	0.93
K	752	128	1.90
L	509	217	0.89
M	382	265	0.79

Use the information provided to list the metals in order of increasing reactivity. **1**

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Question 26 (3 marks)

A certain quantity of gas has a volume of 1.40 L at 101 kPa and 80°C. Calculate the pressure needed to compress the gas to 500 mL at 30°C. **3**

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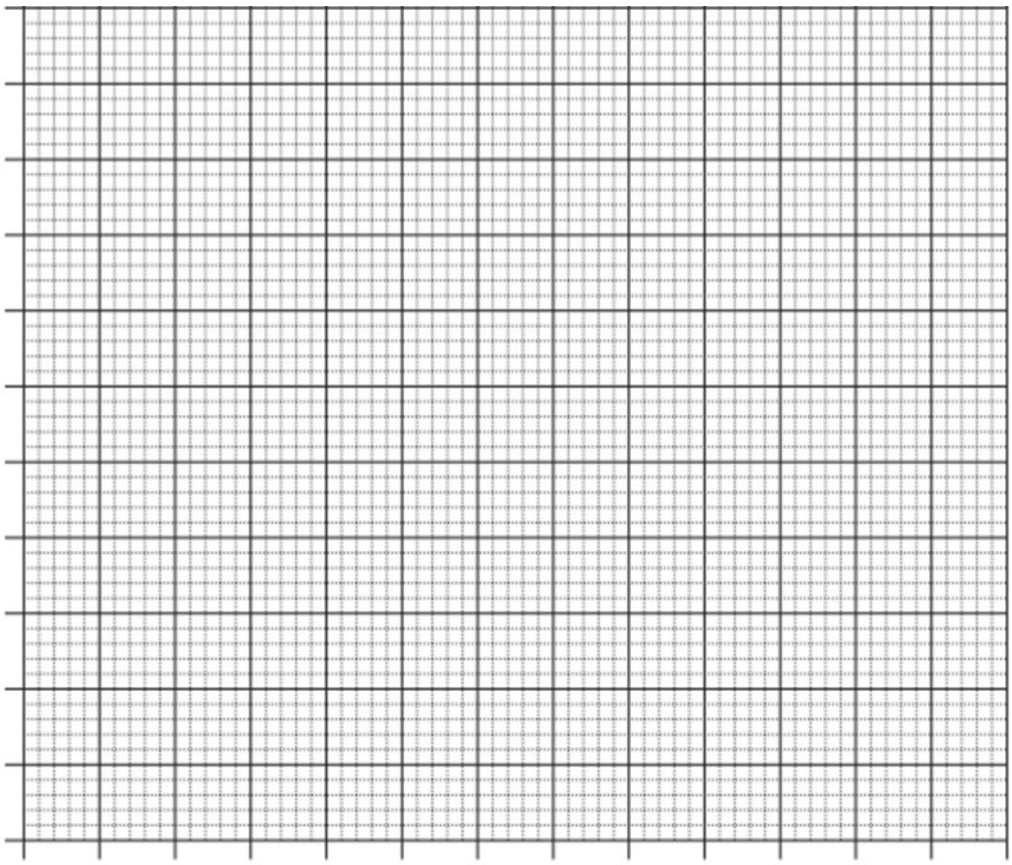
Question 27 (6 marks)

A group of university students carried out an experiment to test Boyle's Law. They applied different pressures to gas in a 50 mL syringe. At each pressure applied, the volume of gas was measured and recorded.

The following table shows their results.

Pressure applied (kPa)	102	118	134	164	82	66
Volume (mL)	25	21	18	16	30	39

a) Graph the results in the space below. **4**



b) With reference to your graph, explain if the results obtained verify Boyle's law. **2**

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Question 28 (4 marks)

A student mixed a solution of lead(II) nitrate with potassium iodide and observed the following result:



a) Identify the type of reaction that occurred. **1**

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b) Write a balanced chemical equation for the reaction. **1**

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c) Construct chemical equations to show the following reactions:

i. Calcium hydroxide is added to dilute sulfuric acid: **1**

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ii. Propane burns completely in air: **1**

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End of Examination.