BA PROVINCIAL FREE BIRD INSTITUTE

ANNUAL EXAMINATION 2020

YEAR 12 CHEMISTRY

Time Allowed: 3 hours
(An extra 10 minutes is allowed for reading this paper)

INSTRUCTIONS

1. Write your **Name** on the front page.
2. Write **all** your answers in the **Answer Booklet** provided.
3. If you use extra sheets of paper, be sure to show clearly the question number(s) being answered and to tie each sheet in your **Answer Booklet** at the appropriate places. Ensure that your **Name** is written on the extra sheets.
4. Answer **all** the questions with a blue **or** black ballpoint pen or ink pen. Do **not** use red ink. You may use a pencil **only** for drawing.
5. You may use a calculator, provided it is silent, battery-operated and non-programmable.
6. There are five strands in this paper. All the strands are **compulsory**.

Note:

- A Periodic Table of Elements is provided for your use during the examination. Both the **atomic number** and the **relative atomic mass** for each element are given.
- Final answers to calculations must be expressed to **two** decimal places.

SUMMARY OF QUESTIONS

	Strand	Multiple - choice questions	Short answer questions	Total marks	Suggested time
1	**General Chemistry** All the questions are compulsory.	2	8	10	18 minutes
2	**Investigating Matter** All the questions are compulsory.	4	16	20	36 minutes
3	**Reactions** All the questions are compulsory.	6	24	30	54 minutes
4	**Materials** All the questions are compulsory.	5	20	25	45 minutes
5	**Consumer Chemistry** All the questions are compulsory.	3	12	15	27 minutes
	Total	**20**	**80**	**100**	**180 minutes**

INSTRUCTIONS

MULTIPLE-CHOICE QUESTIONS

The multiple-choice questions are **all compulsory**. Each question is worth 1 mark.

1. In your **Answer Booklet**, **circle** the letter of the **best** answer. If you change your mind, put a line through your first circle and draw a circle around the letter of your next choice. For example :

12	A	~~B~~	(C)	D

2. **If you change your mind** again and like your first answer better, put a line through your second circle and tick (√) your first answer.

12	A	~~B~~	~~C~~	D

3. **No mark** will be given if you circle more than one letter as the answer for a question.

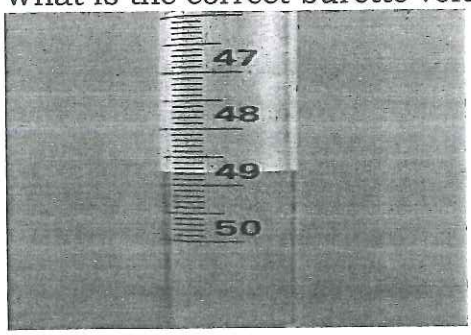
STRAND 1 GENERAL CHEMISTRY **[10 marks]**

- This strand has **5 Questions**.
- **Circle** the letter of the **best** answer in the **Answer Booklet** for **Questions 1 and 2**.
- Write the answer for **Questions 3 – 5** in the space provided in the **Answer Booklet**.

1. Repeated measurements of a quantity can reduce the effects of
   A. both random errors and systematic errors
   B. neither random errors nor random errors
   C. random errors
   D. systematic errors **(1 mark)**

2. Which tool for measuring volume provides the most accurate measurement?
   A. beaker
   B. graduated cylinder
   C. burette
   D. electronic balance **(1 mark)**

3. What is the correct burette volume reading(ml), including the uncertainty?



(2 marks)

4. The following measurements were made to determine the density of a material whose value was, according to the Handbook of Chemistry and Physics, 1.24 g/mL

Trial #1 : 1.20 g/mL
Trial #2 : 1.22 g/mL
Trial #3 : 1.22 g/mL

a) Make a general comment on the accuracy of these results. **(1 mark)**

b) Make a general comment on the precision of these results. **(1 mark)**

c) What may have caused these results? **(1 mark)**

5. A sample of seawater contains 6.277 g of sodium chloride per liter of solution. How many mg of sodium chloride would be contained in 15.0 mL of this solution? **(2 marks)**

6. What are the two essential components of measurement? **(1 mark)**

STRAND 2 INVESTIGATING MATTER [20 marks]

- This strand has **10 Questions**.
- **Circle** the letter of the **best** answer in the **Answer Booklet** for **Questions 1 – 4**.
- Write the answer for **Questions 5 – 10** in the space provided in the **Answer Booklet**.

1. Electronegativity is

   A. how good an atom is at attracting electrons

   B. the ability of an atom to lose electrons

   C. the energy required to remove an electron from a specific atom

   D. How easy it is to make friends. **(1 mark)**

2. Which of the following is a definition of a nonpolar covalent bond?

   A. When two atoms share a pair of electrons with each other

   B. When no electrons are shared between atoms

   C. When two atoms share protons with each other

   D. When one atom in a molecule has a partial charge because of unequal electron sharing **(1 mark)**

3. The electron group geometry and molecular geometry of NH_3 respectively are

   A. Trigonal Pyramid , Tetrahedral

   B. Tetrahedral , Trigonal Pyramid

   C. Trigonal Pyramid, Trigonal Planar

   D. Trigonal Planar, Trigonal Pyramid **(1 mark)**

4. Which of the following compound conducts electricity in molten state but not in solid form?
   A. Potassium chloride
   B. Ammonia
   C. Carbon tetrachloride
   D. Silicon dioxide **(1 mark)**
5. Write Lewis structures for SF_2 and determine its electron group geometry. **(2 marks)**
6. From their positions in the periodic table, arrange the atoms in each of the following series in order of increasing electronegativity:

   C, F, H, N **(1 mark)**
7. Account for the following properties in terms of the structure and bonding of the solids.
   a) Copper is a good conductor of electricity **(1 mark)**
   b) Iodine sublimes at a low temperature. **(1 mark)**
   c) Graphite is a soft greasy solid. **(1 mark)**
   d) Diamond is the hardest known substance. **(1 mark)**
8. Discuss briefly the probable reaction between molecules of hydrogen chloride and molecule of water to form aqueous hydrochloric acid. In your explanation refer to the polarity of these molecules. **(2 marks)**
9. Two burettes were setup, one containing water and the other cyclohexane. When a positively- charged rod was brought close to a stream of water running from one burette, the stream was deflected towards the rod. When the same experiment was carried out with cyclohexane, the stream was not deflected.
   i. What do the above results indicate about the polarity of the water molecule and of the cyclohexane molecule? **(2 marks)**
   ii. Relate the observations made in the experiment with the charged rod to the polarity of individual bonds within these molecules, and to the molecular shape? **(2 marks)**
   iii. Predict what would happen in each case if the experiment described in (ii) were repeated using a rod with a negative charge. **(1 mark)**
10. Differentiate between polar and non-polar covalent bond using examples. **(2 marks)**

STRAND 3 REACTIONS **[30 marks]**

- This strand has **13 Questions.**
- **Circle** the letter of the **best** answer in the **Answer Booklet** for **Questions 1 – 6.**
- Write the answer for **Questions 7 – 13** in the space provided in the **Answer Booklet.**

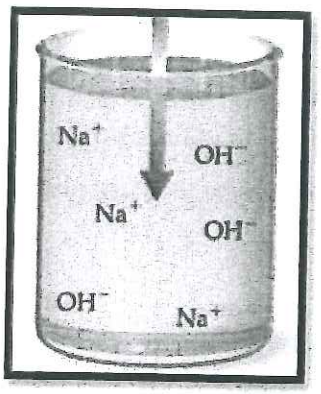
1. Which of the following is true about endothermic reaction?
   A. the products and reactants have the same energy.
   B. the products contain more energy than the reactants.
   C. The surroundings of the reaction vessel increase in temperature as the reaction proceeds
   D. The temperature in the reaction vessel increases as the reaction proceeds.

   (1 mark)

2. Which metal will not produce hydrogen gas when reacted with dilute sulphuric acid?
   A. Cu
   B. Pb
   C. Fe
   D. Zn

   (1 mark)

3. The solution shown in the beaker below is an example of a _____ _____ solution.



   A. weak acid
   B. weak base
   C. strong acid
   D. strong base

   (1 mark)

4. what is the role of a catalyst in a chemical reaction

   A. to lower the activation energy

   B. to produce a greater enthalpy change, thus speed up the reaction

   C. to increase the rate of the forward reaction only

   D. to increase the numerical value of the equilibrium constant **(1 mark)**

5. Which one of the following compounds would have the strongest tendency to donate protons to a base?

   A. NaOH

   B. H_3PO_4

   C. $HClO_4$

   D. $Mg(OH)_2$ **(1 mark)**

6. To measure out 21.4ml of a liquid a student should use a

   A. Burette

   B. Pipette

   C. Measuring cylinder

   D. Beaker **(1 mark)**

7. Aluminium metal is obtained by the electrolysis of a fused mixture of alumina in cryolite.

   a) Write the ion-electron equation for the reaction that occurs at the cathode? **(1 mark)**

   b) What is the function of cryolite in this process? **(1 mark)**

   c) Give the chemical formula and the chemical name for alumina. **(2 marks)**

   d) What is the total mass (amu) of ***carbon*** in $C_{12}H_{10}O_6$ molecules? **(2 marks)**

8. Given the following reaction:

   $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

   How many moles of CO_2 will be produced from 97.0g of C_3H_8, assuming O_2 is available in excess? (Round to three significant figures) **(2 marks)**

9. Determine the empirical and molecular formula for chrysotile asbestos. Chrysotile has the following percent composition: 28.03% Mg, 21.60% Si, 1.16% H, and 49.21% O. The molar mass for chrysotile is 520.8 g/mol. **(2 marks)**

10. A sample of hydrated calcium sulphate, $CaSO_4.xH_2O$, has a relative formula mass of 172. What is the value of x? **(2 marks)**

11. In a titration, 25.00 cm^3 of 0.200 mol/dm^3 sodium hydroxide solution is exactly neutralized by 22.70 cm^3 of a dilute solution of hydrochloric acid.

$NaOH_{(aq)} + HCl_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(l)}$

a) Calculate the amount of sodium hydroxide in moles **(1 mark)**
b) Find the amount of hydrochloric acid in moles **(1 mark)**
c) Calculate the concentration of hydrochloric acid in mol/dm^3 **(1 mark)**
d) Calculate the concentration of hydrochloric acid in g/dm^3 **(1 mark)**

12. Write balanced ion- electron equations for each question below.
a) $SO_2 \rightarrow SO_4^{2-}$ **(1 mark)**
b) $Cr_2O_7^{2-} \rightarrow Cr^{3+}$ **(1 mark)**
c) Indicate which of these ion electron equations show reduction (a) or (b). **(1 mark)**

13. Sulphuric acid is manufactured in new Zealand by the Contact Process. A step in this process involves the following reaction.

$$2SO_{2(g)} + O_{2(g)} \rightarrow 2SO_{3(g)} \quad \Delta H = -200 kJmol^{-1}$$

a) Write an expression for the equilibrium constant, K_c, for this reaction. **(1mark)**
b) What would you predict about the equilibrium concentration of sulphur trioxide, SO_3, if the system underwent a decrease in pressure by increasing the volume while the temperature remained constant? Give a reason. **(1 mark)**
c) Although this is an exothermic reaction, it is normally carried out at about 450°C. suggest a reason for this. **(1 mark)**

d) Name the catalyst used in the reaction. What is the role of the catalyst? **(2 marks)**

STRAND 4 MATERIALS **[25 marks]**

- This strand has **13 Questions**.
- **Circle** the letter of the **best** answer in the **Answer Booklet** for **Questions 1 – 5**.
- Write the answer for **Questions 6 – 13** in the space provided in the **Answer Booklet**.

1. Which of the following elements has the most basic oxide?
   A. Silicon
   B. Magnesium
   C. Chlorine
   D. Phosphorus **(1 mark)**

2. Which of the following compounds has the lowest melting point?
   A. NaCl
   B. $AlCl_3$
   C. $SiCl_4$
   D. PCl_3 **(1 mark)**

3. Select the compound that can have geometrical isomers:
   A. $CH_2=CH_2$
   B. $CHBr=CH_2$
   C. CHBr=CHBr
   D. $CHBr=CBr_2$ **(1 mark)**

4. When a mixture of ethanol, ethanoic acid and sulphuric acid is warmed in a test tube:
   A. The mixture separates into two layers
   B. A pleasant, fruity vapour is smelt
   C. The mixture turns green
   D. An orange brown vapour is seen **(1 mark)**

5. When ethene is bubbled through bromine water:
   A. The brown solution slowly clears
   B. A brown precipitate form
   C. The solution remains clear
   D. The clear solutions slowly goes brown **(1 mark)**