COMPOSITIONS GROUPEES

ECOLE JEANNINE MANUEL

2nde International Chemistry

November 2016

Parent's Signature .....

Teacher: Mr. Osler

Total Time: **1h 15min**

Reading Time: **5 minutes**

Writing Time: **1h 10min**

Total mark value 59/ **60 Student's mark /20** .....20.....

Name .....Jingjie YANG.....

Class 2I-CHM1

INSTRUCTIONS

Read through the exam paper before you begin to write your answers.

The paper consists of two sections.

Part A Circle the response that is the best answer for the question.

Part B Answer the questions in the spaces provided.

The Periodic Table is available on the back page.

Calculators are permitted.

Dictionaries are not permitted except for Adaptation students.

Part A (circle ONE answer from the choices A to D)

Atomic Theory

1. What is the electron arrangement of the Mg^{2+} ion?

A. 2,2

B. 2,8

C. 2,8,8

D. 2,8,2

2. Which of the following is an isotope of $^{24}_{12}Mg$?

A. $^{24}_{12}Mg^{2+}$

B. $^{26}_{12}Mg$

C. $^{26}_{13}Mg$

D. $^{42}_{13}Mg$

3. Which of the following pairs of species would have the greatest similarities in chemical properties?

A. ^{39}K and $^{39}K^{+}$

B. ^{39}K and ^{40}K

C. ^{19}K and ^{23}Na

D. ^{40}K and ^{40}Ca

4. Which quantities are the same for all atoms of chlorine?

I. Number of protons

II. Number of neutrons

III. Number of electrons

A. I and II only

B. II and III only

C. I and III only

D. I, II and III

5. Consider the relative abundance of the isotopes of element X.

Isotope	Relative abundance (%)
^{24}X	80
^{25}X	10
^{26}X	10

What is the relative atomic mass of X?

A. 25

B. 26

C. Between 24 and 25

D. Between 25 and 26

6. What is the symbol for a species that contains 15 protons, 16 neutrons and 18 electrons?

A. $^{31}_{15}P^{3-}$

B. $^{31}_{15}P^{-}$

C. $^{31}_{16}S$

D. $^{31}_{16}S^{3-}$

7. Which equation best represents the first ionization energy of bromine?

A. $Br_2(g) \rightarrow 2Br(g)$

B. $Br(g) \rightarrow Br^+(g) + e^-$

C. $Br(g) + e^- \rightarrow Br^-(g)$

D. $Br(l) \rightarrow Br^+(g) + e^-$

8. Which statement about the numbers of protons, electrons and neutrons in an atom is always correct?

A. The number of neutrons minus the number of electrons is zero.

B. The number of protons plus the number of neutrons equals the number of electrons.

C. The number of protons equals the number of electrons.

D. The number of neutrons equals the number of protons.

Periodic Table

9. In which pair is the first species larger than the second?

A. Cl and Cl^-

B. Na and K

C. Si and Cl

D. Li and Li^+

smaller.

10. Which property **decreases** down group 1?

A. First ionization energy

B. Melting point

C. Reactivity

D. Electronegativity

11. Which statements about the periodic table are correct?

I. Elements in period 3 have similar chemical properties.

II. Elements in group 7 show a gradual change in physical properties.

III. The position of an element in period 3 is related to the number of electrons in the highest occupied energy level.

A. I and II only

B. II and III only

C. I and III only

D. I, II and III

12. Strontium is an element in the same group of the periodic table as magnesium and calcium. It is likely to be a metal which has a

A. high melting point and reacts vigorously with water.

B. high melting point and reacts slowly with water.

C. low melting point and reacts slowly with water.

D. low melting point and reacts vigorously with water.

13. Which pair of elements reacts most readily?

A. $K + Cl_2$

B. $K + Br_2$

C. $Na + Br_2$

D. $Na + Cl_2$

14. Which of the reactions below occur as written?

I. $Br_2 + 2\ I^- \rightarrow 2\ Br^- + I_2$

II. $Cl_2 + 2I^- \rightarrow 2Cl^- + I_2$

A. I only

B. II only

C. Both I and II

D. Neither I nor II

Bonding Structure

15. What is the formula for the compound formed by calcium and nitrogen?

A. CaN

B. Ca_2N

C. Ca_2N_3

D. Ca_3N_2

16. Which combination of the characteristics of element X, a metal, and element Y, a non metal, is most likely to lead to ionic bonding?

	X	Y
A.	low ionization energy	high electronegativity value
B.	low ionization energy	low electronegativity value
C.	high ionization energy	high electronegativity value
D.	high ionization energy	low electronegativity value

17.

Which is the best description of ionic bonding?

A. The electrostatic attraction between positively charged nuclei and an electron pair

B. The electrostatic attraction between positive ions and delocalized negative ions

C. The electrostatic attraction between positive ions and delocalized electrons

D. The electrostatic attraction between oppositely charged ions ✓

18.

Which statement describes the trends of electronegativity values in the periodic table?

A. Values increase from left to right across a period and increase down a group.

B. Values increase from left to right across a period and decrease down a group. ✓

C. Values decrease from left to right across a period and increase down a group.

D. Values decrease from left to right across a period and decrease down a group.

Chemical Equations and formula

19. What is the sum of all coefficients when the following equation is balanced using the smallest possible whole numbers?

$$\underline{1}\ C_3H_8 + \underline{5}\ O_2 \rightarrow \underline{3}\ CO_2 + \underline{4}\ H_2O$$

A. 7

B. 9

C. 11

D. 13 ✓

20. Which is a correct definition of the term *empirical formula*?

A. formula showing the numbers of elements present in a compound

B. formula showing the numbers of atoms present in a compound

C. formula showing the simplest ratio each element in a compound ✓

D. formula showing the actual numbers of atoms of each element in a compound

19/20

PART B

1. Part of the Periodic Table which Mendeleev published in 1869 is shown below.
Use the Periodic Table to help you to answer this question.

(i)

Group / Period	I	II	III	IV	V	VI	VII	VIII
1	H=1							
2	Li=7	Be=9.4	B=11	C=12	N=14	O=16	F=19	
3	Na=23	Mg=24	Al=27.3	Si=28	P=31	S=32	Cl=35.5	
4	K=39	Ca=40	?=44	Ti=48	V=51	Cr=52	Mn=55	Fe=56,Co=59 Ni=59
5	Cu=63	Zn=65	?=68	?=72	As=75	Se=78	Br=80	
6	Rb=85	Sr=87	?Yt=88	Zr=90	Nb=94	Mo=96	?=100	Ru=104,Rh=104 Pd=106
7	Ag=108	Cd=112	In=113	Sn=118	Sb=122	Te=125	J=127	
8	Cs=133	Ba=137	?Di=138	?Ce=140				
9								
10			?Er=178	?La=180	Ta=182	W=184		Os=195,Ir=197 Pt=198
11	Au=199	Hg=200	Tl=204	Pb=207	Bi=208			
12				Th=231		U=240		

http://web.fccj.org/~ethall/2045/ch5/mendelev.htm

(a) (i) Give the symbols of **two** elements in Group 6 of Mendeleev's Periodic Table which are **not** found in Group 16 of the modern Periodic Table.

..... Cr ..... and ..... Mo .....

(1)

(ii) Name these **two** elements

..... crucium ..... and ..... morellium .....

(1)

(b) Suggest why the noble gases are missing from Mendeleev's table?

Because noble gases don't react with other elements, and the technology of Mendeleev's time doesn't allow chemists to extract these elements from the air.

(1)

(c) Mendeleev left several gaps in his Periodic Table. These gaps are shown a question mark (?) on the table above. Suggest why Mendeleev left these gaps.

Because his periodic table suggests that there are existent elements which are yet to be discovered at those gaps.

(1)

(d) Complete the following sentence.

In the **modern** Periodic Table the elements are arranged in the order of their

.....atomic..... numbers.

(1)

(e) Mendeleev placed magnesium, calcium and strontium in Group 2 of his Periodic Table. This was because they have similar properties. Some properties of elements are given in the table. **Four** of them are properties of magnesium, calcium and strontium. One of these properties has been ticked for you. Place a tick next to the other three properties.

PROPERTY	
They react with water to give alkaline solutions.	X
They are gases.	
They are non-metals.	
They form an ion with a 2+ charge.	X
They react with water and give off hydrogen.	X
They form an ion with a 2^- charge.	
They are metals.	**X**
They react with water to give acidic solutions.	

3/3

(3)

2.

Lithium exists as two isotopes with mass numbers of 6 and 7. Deduce the number of protons, electrons and neutrons for each isotope.

Mass number (A)	Number of protons	Number of electrons	Number of neutrons
6	3	3	3
7	3	3	4

✓ ✓ (1)(1)

Periodic trends enable chemists to predict the behaviour of related compounds.

(a) (i) State the equation for the reaction of sodium metal with water. *[1]*

$2Na_{(s)} + 2H_2O_{(l)} \rightarrow 2NaOH_{(aq)} + H_{2(g)}$

(1)(1)

(ii) Describe **two** changes that could be observed during the reaction. *[2]*

1) Heat is given off from the vigorous reaction, which might light the hydrogen gas; ✓
2) Bubbles of hydrogen appear at the surface of the solution. ✓

2/2

(iii) Predict the relative reaction rates of lithium, sodium and potassium with water. *[1]*

Potassium reacts the most violently with water, and sodium less so, and lithium reacts the least vigorously. ✓

(1)(1)

3. Chlorine is a reactive element in group 7 of the Periodic Table. Chlorine reacts with many elements in the Periodic Table except the noble gases.

(a) (i) The electronic structure of fluorine is 2.7. What is the electronic structure of chlorine?

2.8.7 ✓ 1/1

(1)

(ii) What is the electronic structure of the fluoride ion F^-?

2.8 ✓ 1/1

(1)

(b) Write a balanced equation for the reaction between chlorine and potassium bromide in aqueous solution

$Cl_2(g) + 2KBr(aq) \rightarrow Br_2(l) + 2KCl(aq)$ ✓ 2/2

(2)

(c) Explain why chlorine displaces bromine from potassium bromide solution?

Because chlorine has a smaller atomic radium and less repulsion from inner shells than bromine, and therefore electrons are more easily attracted to chlorine than bromine. ✓ 2/2

(2)

4. Use the Periodic Table to help you to answer this question.

State **one** similarity and **one** difference in the electronic structure of the elements:

(a) across the Period from lithium to neon;

They all have two occupied energy levels; ✓
The have different number of valence electrons. ✓ 2/2

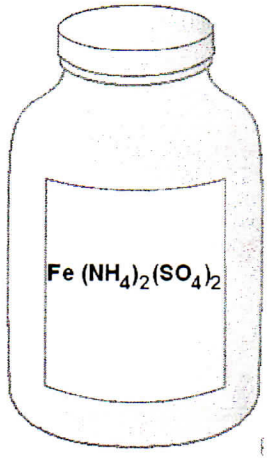
(2)

(b) down Group 7 from fluorine to astatine.

They all have 7 electrons on their highest occupied energy level; they have different numbers of occupied energy levels. ✓ 2/2

(2)

5. The drawing shows a container of a compound commonly called Mohr's salt.



(a) How many different elements are present in Mohr's salt?

5 ✓ 1/1

(1)

(b) How many **negative** ions are there in the formula for Mohr's salt?

1 ✓ 1/1

(1)

(c) Iron ions can have different charges. If the compound is neutral, what is the charge on the iron ion in Mohr's salt?

2+ ✓ 1/1

(1)

(d) Suggest **two** properties which Mohr's salt has because it is an ionic compound.

Property 1 It has relatively high boiling and melting points. ✓ 1/1

Property 2 It can conduct electricity when it is dissolved in water or in molten state. ✓ 2/2

(2)

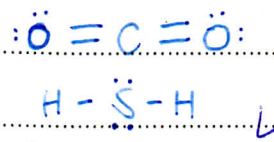
(e) Describe the type of bonding present in the compound formed between fluorine and nitrogen and state the formula of the compound.

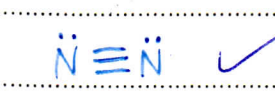
Covalent bonding is present in the compound between non-metals fluorine and nitrogen, which is chemically written as NF_3. ✓ 2/2

(2)

(f) Draw Lewis (electron dot) structures for CO_2 and H_2S and N_2 showing all valence electrons.

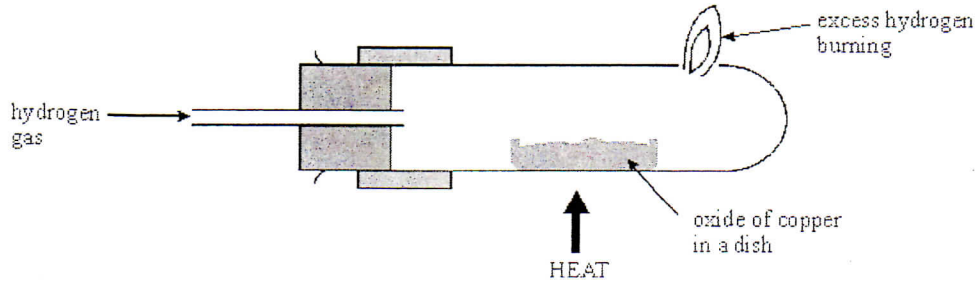
(6)





6/6

6. An oxide of copper was reacted in a stream of hydrogen as shown below.



After heating, the stream of hydrogen gas was maintained until the apparatus had cooled.

The following results were obtained.

Mass of empty dish = 13.80 g
Mass of dish and contents before heating = 21.75 g
Mass of dish and contents after heating and leaving to cool = 20.15 g

(a) Calculate the empirical formula of the oxide of copper using the data above, assuming complete reaction of the oxide.

Before reaction

Mass of oxide of copper : $21.75 - 13.80 = 7.95$ g

Mass of copper after reaction : $20.15 - 13.80 = 6.35$ g

Mass of oxide $7.95 - 6.35 = 1.60$ g

Copper ratio: $r_{Cu} = \frac{6.35}{63.55} = 0.100$

Oxide ratio: $r_O = \frac{1.60}{16.00} = 0.100$

$\therefore r_{Cu} = r_O$

$\therefore$ empirical formula of oxide of copper is CuO.

3/3

(3)

(b) Write an equation for the reaction that occurred.

$CuO_{(s)} + H_{2(g)} \xrightarrow{\Delta} Cu_{(s)} + H_2O_{(g)}$

(1)

(c) State **one** change that would be observed inside the tube as it was heated.

We can see vapor of water from the reaction gathered inside the tube, which could then turn into little drips of liquid water as it is cooled down by touching the tube.

(1)

39+1/40
19/20
58+1/60