Shanghai Pinghe School Academic Year 2022-2023

1st Semester Final Exam for Grade 10

Subject: Chemistry

Time: 90 min

Total Page: 12

NAME: _____ CLASS: _____

Instructions:

1. Do not open this examination paper until instructed to do so.
2. Do not use correction pen or liquid.
3. Answer all the questions in the spaces provided.

Part I – Multiple choices: _____

Part II – Short answer questions:_____

Score:

/ 62

Part I. Multiple choices (1*20) **[Total: 20]**

Directions: Read the following questions carefully and choose the letter of the correct answer (one letter for each question) and fill them into the table below.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1 **H** 1.01						Atomic number **Element** Relative atomic mass											2 **He** 4.00
2	3 **Li** 6.94	4 **Be** 9.01											5 **B** 10.81	6 **C** 12.01	7 **N** 14.01	8 **O** 16.00	9 **F** 19.00	10 **Ne** 20.18
3	11 **Na** 22.99	12 **Mg** 24.31											13 **Al** 26.98	14 **Si** 28.09	15 **P** 30.97	16 **S** 32.07	17 **Cl** 35.45	18 **Ar** 39.95
4	19 **K** 39.10	20 **Ca** 40.08	21 **Sc** 44.96	22 **Ti** 47.87	23 **V** 50.94	24 **Cr** 52.00	25 **Mn** 54.94	26 **Fe** 55.85	27 **Co** 58.93	28 **Ni** 58.69	29 **Cu** 63.55	30 **Zn** 65.38	31 **Ga** 69.72	32 **Ge** 72.63	33 **As** 74.92	34 **Se** 78.96	35 **Br** 79.90	36 **Kr** 83.90
5	37 **Rb** 85.47	38 **Sr** 87.62	39 **Y** 88.91	40 **Zr** 91.22	41 **Nb** 92.91	42 **Mo** 95.96	43 **Tc** (98)	44 **Ru** 101.07	45 **Rh** 102.91	46 **Pd** 106.42	47 **Ag** 107.87	48 **Cd** 112.41	49 **In** 114.82	50 **Sn** 118.71	51 **Sb** 121.76	52 **Te** 127.60	53 **I** 126.90	54 **Xe** 131.29
6	55 **Cs** 132.91	56 **Ba** 137.33	57 † **La** 138.91	72 **Hf** 178.49	73 **Ta** 180.95	74 **W** 183.84	75 **Re** 186.21	76 **Os** 190.23	77 **Ir** 192.22	78 **Pt** 195.08	79 **Au** 196.97	80 **Hg** 200.59	81 **Tl** 204.38	82 **Pb** 207.20	83 **Bi** 208.98	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
7	87 **Fr** (223)	88 **Ra** (226)	89 ‡ **Ac** (227)	104 **Rf** (267)	105 **Db** (268)	106 **Sg** (269)	107 **Bh** (270)	108 **Hs** (269)	109 **Mt** (278)	110 **Ds** (281)	111 **Rg** (281)	112 **Cn** (285)	113 **Uut** (286)	114 **Uuq** (289)	115 **Uup** (288)	116 **Uuh** (293)	117 **Uus** (294)	118 **Uuo** (294)

†	58 **Ce** 140.12	59 **Pr** 140.91	60 **Nd** 144.24	61 **Pm** (145)	62 **Sm** 150.36	63 **Eu** 151.96	64 **Gd** 157.25	65 **Tb** 158.93	66 **Dy** 162.50	67 **Ho** 164.93	68 **Er** 167.26	69 **Tm** 168.93	70 **Yb** 173.05	71 **Lu** 174.97
‡	90 **Th** 232.04	91 **Pa** 231.04	92 **U** 238.03	93 **Np** (237)	94 **Pu** (244)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (262)

1. Which contains the most atoms of oxygen?

A. 64 g of O_2

B. 1.2×10^{24} molecules of O_2

C. 64 g of $C_3H_5O_3$

D. 1.2×10^{24} molecules of $C_3H_5O_3$

2. Burette readings for a titration are shown.

Burette readings / $cm^3 \pm 0.05\,cm^3$	Trial 1	Trial 2	Trial 3
Final	11.35	24.60	11.70
Initial	0.20	13.50	0.50

What is the mean titre?

A. $11.1\ cm^3 \pm 0.1\ cm^3$

B. $11.15\ cm^3 \pm 0.05\ cm^3$

C. $11.2\ cm^3 \pm 0.05\ cm^3$

D. $11.2\ cm^3 \pm 0.1\ cm^3$

3. What volume of oxygen, in dm^3 at STP, is needed when 5.8 g of butane undergoes complete combustion?

$$2C_4H_{10}(g) + 13O_2(g) \rightarrow 8CO_2(g) + 10H_2O(g)$$

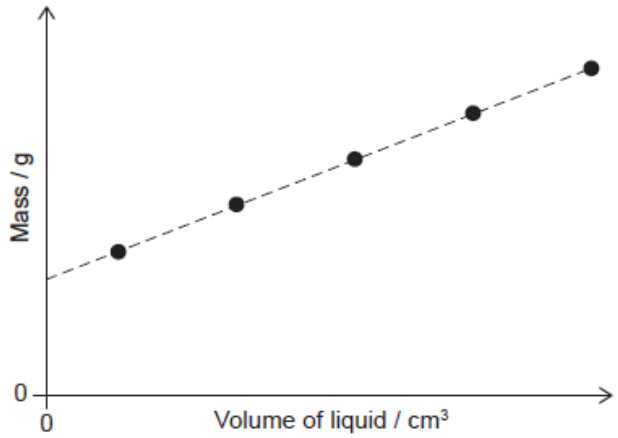
A. $2 \times \frac{5.8}{12.01\times4+1.01\times10} \times 13 \times 22.7$

B. $\frac{5.8}{12.01\times4+1.01\times10} \times \frac{13}{2} \times 22.7$

C. $\frac{5.8}{12.01\times4+1.01\times10} \times \frac{2}{13} \times 22.7$

D. $\frac{5.8}{12.01\times4+1.01\times10} \times \frac{13}{2} \times \frac{22.7}{1000}$

4. A liquid was added to a graduated cylinder. What can be deduced from the graph?



	Gradient	*y*-intercept
A.	density of liquid	amount of liquid
B.	density of liquid	mass of empty cylinder
C.	rate of adding liquid	amount of liquid
D.	rate of adding liquid	mass of empty cylinder

5. What is represented by "2−" in ${}^{A}_{Z}X^{2-}$?

A. loss of electron

B. gain of electron

C. loss of proton

D. gain of proton

6. A sample of a compound contains approximately 24.0 g C, 3.0 g H, and 1.6 g O. What is the empirical formula of the compound?

A. $C_{20}H_{30}O$ B. $C_{84}H_{10}O_6$ C. C_2H_3O D. $C_{24}H_{30}O_2$

7. Which series shows the correct order of metallic bond strength from strongest to weakest?

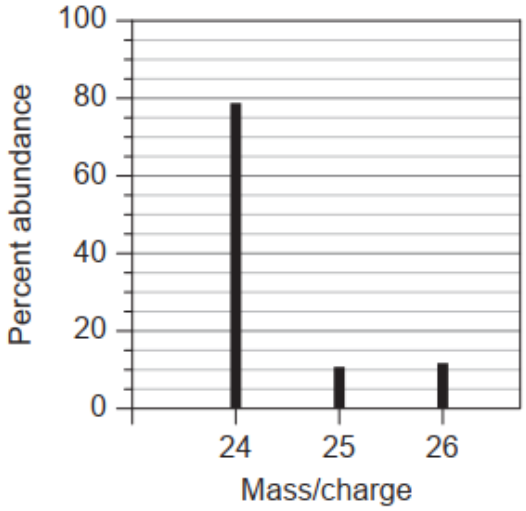
A. $\mathrm{Na} > \mathrm{K} > \mathrm{Rb} > \mathrm{Mg}$

B. $\mathrm{Mg} > \mathrm{Rb} > \mathrm{K} > \mathrm{Na}$

C. $\mathrm{Rb} > \mathrm{K} > \mathrm{Na} > \mathrm{Mg}$

D. $\mathrm{Mg} > \mathrm{Na} > \mathrm{K} > \mathrm{Rb}$

8. What is the relative atomic mass, A_r, of an element with this mass spectrum?



A. 24.0

B. 24.3

C. 24.9

D. 25.0

9. Which is correct?

A. Mixtures are either homogeneous or heterogeneous and their chemical properties are an average of the individual component properties.

B. Mixtures are never heterogeneous and their chemical properties are an average of the individual component properties.

C. Mixtures are either homogeneous or heterogeneous and the components retain their individual chemical properties.

D. Mixtures are never homogeneous and the components retain their individual chemical properties.

B

10. Which is correct for all solid ionic compounds?

A. High volatility

B. Poor electrical conductivity

C. Low melting point

D. Good solubility in water

C

11. The rate of a reaction is studied at different temperatures.

Which is the best way to plot the data?

(independent, dependent 这分清)

	x-axis	Type of variable on *x*-axis
A.	rate	dependent
B.	rate	independent
C.	temperature	independent
D.	temperature	dependent

12. In which set do all the species contain more electrons than neutrons?

A. ^{14}N, ^{16}O, ^{11}C

B. ^{14}N, ^{16}O, $^{11}C^{4-}$

C. $^{14}N^{3-}$, $^{16}O^{2-}$, ^{11}C

D. $^{14}N^{3-}$, $^{16}O^{2-}$, $^{11}C^{4+}$

13. What is the order of decreasing ionic radius?

A. $S^{2-} > Cl^{-} > Al^{3+} > Mg^{2+}$

B. $Cl^{-} > S^{2-} > Al^{3+} > Mg^{2+}$

C. $S^{2-} > Cl^{-} > Mg^{2+} > Al^{3+}$

D. $Mg^{2+} > Al^{3+} > Cl^{-} > S^{2-}$

14. X, Y and Z represent the successive elements, Ne, Na and Mg, but not necessarily in that order.

	First ionization energy / kJ mol^{-1}
X	2081
Y	496
Z	738

What is the order of increasing atomic number?

A. X < Y < Z

B. X < Z < Y

C. Y < Z < X

D. Y < X < Z

15. Which compound contains both ionic and covalent bonds?

A. MgO

B. CH_2Cl_2

C. CH_3COOH

D. NaOH

16. Which of the following is a mixture?

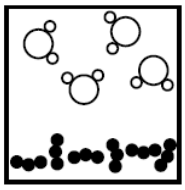
A. CaCO3

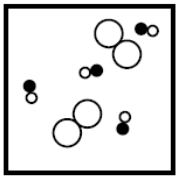
B. Ozone

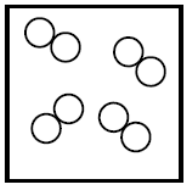
C. CuSO4·5H2O

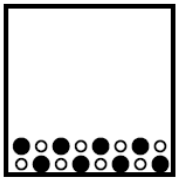
D. Brass

17. Which diagram represents a heterogeneous mixture?

A. 

B. 

C. 

D. 

A

18. Which statements about the periodic table are correct?

I. The elements Mg, Ca and Sr have similar chemical properties.

II. Elements in the same period have the same number of main energy levels.

III. The atomic radius of Na, Mg and P ~~increases~~ decrease as atomic number increases.

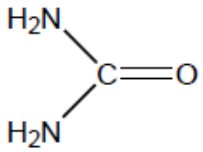
A. I and II only B. I and III only

C. II and III only D. I, II and III

19. A measuring cylinder was used to obtain a known volume of a liquid. The volume was read from the top of the meniscus and the liquid completely emptied into a flask. The exact same process was then repeated. Which statement is correct about the overall described procedure and the volumes measured?

A. There is a systematic error and the volumes measured are accurate.
B. There is a random error and the volumes measured are accurate.
C. There is a random error and the volumes measured are inaccurate.
D. There is a systematic error and the volumes measured are inaccurate.

20. How many bonding electrons are there in the urea molecule?



A. 8

B. 16

C. 20

D. 24

Part II. Short-answer and data based questions **[Total: 42 marks]**

Directions: Read the following questions carefully and answer the questions in the spaces provided.

1. Complete the following tables. **[3]**

Formula	IUPAC Name
$Mn_3(PO_3)_2$	Manganese (II) phosphite. (phosphate 磷酸)
P_4O_{10}	
HBrO	

2. a) **State** the electron arrangement for the P^{3-} ion. **[1]**

.....

.....

b) **Explain** why the ionic radius of the S^{2-} ion is smaller than that of the P^{3-} ion. **[2]**

.....

.....

c) **Define** 1st ionization energy **[2]**

minimum energy required to remove an electron from the valence shell of a gaseous atom to form a positive ion

d) **Describe** the chemical bonding in group 1 elements, **state and explain** the trend in melting point. **[3]**

the bonding in Group 1 is metalic bonding. Down the group the melting point of group 1 elements decrease. Down the group they have the same ENC but greater radius, less 1st ionization energy, so there is less electrostastic attraction between nucleus and valance electron, so there goes decreasing melting point.

.....

.....

e) Write down the equation for 1st ionization of Cl **including state symbols**. **[2]**

Cl(g)-> Cl+(g)+e-

.....

f) Explain why solid potassium can conduct electricity but solid potassium bromide cannot. **[2]**

Delocolized electron, K+ and Cl- held tightly in solid KCl crystal structure and can not move.

.....

g) Compare the melting points of KCl and K_2S. **[2]**

Attraction between K+ and Cl- or K+ and S2-. Electronic Stastic attraction of KCl is smaller than K2S because 1*1<1*2

.....

[total 14 marks]

3. A 0.6125 g$\pm$0.0001g sample of potassium iodate is dissolved in distilled water and made up to 250.00 cm^3 $\pm$0.05 cm^3 in a volumetric flask. A 25.00 $\pm$ 0.05cm^3 portion of the solution is transferred by a cylinder added to an excess of acidified potassium iodide solution. The iodine formed requires 24.50 $\pm$ 0.05 cm^3 of sodium thiosulfate solution for titration.

$IO_3^-(aq) + 5I^-(aq) + 6H^+(aq) \rightarrow 3I_2 + 3H_2O(l)$

$2S_2O_3^{2-}(aq) + I_2(aq) \rightarrow 2I^-(aq) + S_4O_6^{2-}(aq)$

Determine the concentration of the sodium thiosulfate solution with absolute uncertainty.

$n_{IO_3^-} = n_{KIO_3} = \frac{0.6125}{39.10+126.90+16.00\times3} = 0.002862$ mol

$n_{IO_3^-}' = \frac{1}{10} \cdot 0.002862 = 0.0002862$ mol

$n_{I_2} = \frac{1}{3} n_{IO_3^-}' = \frac{0.0002862}{3} = 0.0000954$ mol

$n_{S_2O_3^{2-}} = 2n_{I_2} = \frac{2\times0.0002862}{3} = 0.000198$ mol

$c_{Na_2S_2O_3} = \frac{n_{S_2O_3^{2-}}}{V_{Na_2S_2O_3}} = \frac{0.000198}{24.50\times10^{-3}} = 0.0778$ mol/L

$\frac{\Delta c_{Na_2S_2O_3}}{c_{Na_2S_2O_3}} = \frac{\Delta m_{IO_3^-}}{m_{IO_3^-}} + \frac{\Delta V}{V} + \frac{\Delta V'}{V'} + \frac{\Delta V_{Na_2S_2O_3}}{V_{Na_2S_2O_3}}$

$\Delta c_{Na_2S_2O_3} = \pm 0.0004$ mol/L

$c_{Na_2S_2O_3} = 0.0778 \pm 0.0004$ mol/L **[total 5 marks]**

4. Students A and B are doing the same investigation about titration to determine the concentration of 25 cm^3 NaOH(aq) titrated with 0.100M HCl solution.

Students A and B uses a 25 cm^3 pipette with uncertainty of $\pm$0.05cm^3.

The data collected is on the table:

Experiment	Titration with 0.100M HCl solution using burette, $\pm$0.05cm^3				
Student A	Initial reading	0.00	0.00	0.00	0.00
	Final reading	11.30	10.80	11.00	10.50
Student B	Initial reading	0.00	10.30	0.00	10.20
	Final reading	10.20	20.40	10.20	20.50

a) Discuss which set of data is more precise. [2]

b) Calculate the concentration of NaOH solution for both student A and B, and state whether student A or B has more accurate concentration of NaOH solution, if the literature value for concentration of NaOH solution is 0.0410 M. [3]

c) Student A found out that the burette was not rinsed with hydrochloric acid prior to filling; State and explain how this would affect the calculated concentration of base. [2]

d) Student B used the wet conical flask prior to transferring base into it; State and explain how this would affect the calculated concentration of base. [2]

[total 9 marks]

5. This question is about compounds of sodium.

(a) Sodium can react with oxygen to form sodium oxide. Describe the structure and bonding in solid sodium oxide. [2 marks]

(b)Compare and explain the electrical conductivity of molten sodium oxide.

[1 marks]

(c). Sodium can react with water.

(i)Write down the balanced equation to present the reaction between sodium and water including state symbol [1 mark]

(ii) Calculate the volume of gas produced if 3.20g sodium is reacted with excess of water at STP.

[2 marks]

(iii) If the student collected 0.0432mol of gas in this experiment, calculate the percentage yield.

[1 mark]

(iv) Calculate the percentage error in part (iii). [1 mark]

[total 8 marks]

6. Draw the Lewis structures of a. nitrite b. silicon tetrachloride c. carbon disulfide.
[3 marks]

The End