FUKIEN SECONDARY SCHOOL

S3 Final Examination (2020-2021)

Chemistry

(1 hour)

Date: 22nd June 2021 Name: _____

Time: 8:30a.m. - 9:30a.m. Class: _____ No.: _____

Instructions to students:

1. Write your name, class and class number on both the question paper and the answer sheets.
2. Answer ALL questions.
3. Write down all the answers on the answer sheets.
4. Hand in the question paper and the answer sheets at the end of the examination.
5. The total mark of the paper is 90.

I. Multiple Choice Questions (20 marks)

1. The atomic symbol of a barium atom is ^{137}Ba. Which of the following combinations is correct?

	Number of protons	Number of electrons	Number of neutrons
A.	81	56	56
B.	56	81	81
C.	81	81	56
D.	56	56	81

2. Silicon has three isotopes. The table below shows the relative abundance of each of these isotopes.

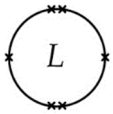
Isotope	Relative abundance (%)
^{28}Si	92.2
^{29}Si	4.7
^{30}Si	3.1

What is the relative atomic mass of silicon?

A. 28.0
B. 28.1
C. 28.2
D. 28.3

3. Element *M* has two isotopes, ^{104}M and ^{106}M. The relative atomic mass of *M* is 104.4. What is the relative abundance of ^{106}M?
   A. 10%
   B. 20%
   C. 30%
   D. 40%

4. The electron diagram of an atom of element *L* is shown below (only electrons in the outermost shell are shown):



   The atomic number of *L* is probably
   A. 8.
   B. 14.
   C. 18.
   D. 20.

5. The chemical properties of an element depend on
   A. the number of neutrons in its atom.
   B. its relative atomic mass.
   C. the number of occupied electron shells in its atom.
   D. the number of electrons in the outermost shell in its atom.

6. Which of the following statements about elements in the same group is/are correct?
   (1) They have the same number of electrons in the outermost shell.
   (2) They have similar chemical properties.
   (3) They have the same colour.
   A. (1) only
   B. (2) only
   C. (1) and (3) only
   D. (2) and (3) only

7. Which of the following statements about sodium and potassium is correct?
   A. They are in the same period of the Periodic Table.
   B. They burn with the same flame colour.
   C. They have the same reactivity.
   D. They react similarly with water.

8. An unknown element has two outermost shell electrons. Which of the following statements about this element are INCORRECT?

(1) It must conduct electricity.
(2) It must be a metal.
(3) It has at least two protons.

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

9. Astatine is a Group VII element below iodine in the Periodic Table. Which of the following statements are correct?

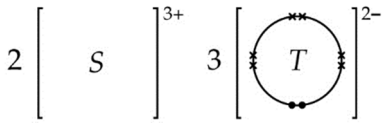
(1) Astatine is less reactive than fluorine.
(2) Astatine and iodine have similar chemical properties.
(3) Astatine and iodine have the same number of occupied electron shells.

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

10. *X* is a Group VII element. Which of the following statements about *X* must be correct?

A. *X* needs one more electron to attain an octet structure.
B. *X* reacts with metal to form an ionic compound.
C. It reacts with non-metal to form a covalent compound.
D. It must be a gas at room conditions.

11. The electron diagram of the compound formed between element *S* and element *T* is shown below (only outermost shell electrons are shown).



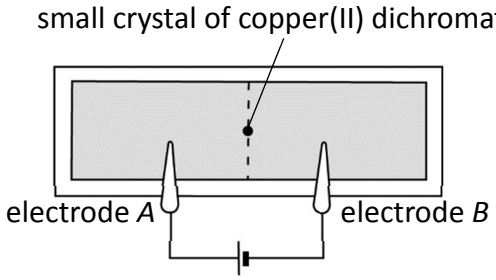
How many electrons are there in the outermost shell of a *S* atom and a *T* atom?

	S	*T*
A.	2	3
B.	3	2
C.	3	6
D.	2	8

12. MN_2 is the formula of ionic compound *X*. Both *M* and *N* have the same electronic arrangement in the compound. Compound *X* would be

A. calcium chloride.
B. carbon dioxide.
C. magnesium bromide.
D. sodium fluoride.

13. Consider the following set-up about the migration of ions.



Which of the following observations is correct?

A. Purple spot moves towards electrode *A*.
B. Blue spot moves towards electrode *B*.
C. Orange spot moves towards electrode *B*.
D. There is no observable change.

14. Which of the following combinations can give a covalent compound?

A. Group II element + Group VII element
B. Group VI element + Group VII element
C. Group I element + Group 0 element
D. Group VI element + Group 0 element

15. Which of the following combinations about the molecular formula and the relative molecular mass of sulphur dioxide is correct?

	Molecular formula	Relative molecular mass
A.	SO_3	80.1
B.	SO_3	80.1 g
C.	SO_2	64.1
D.	SO_2	64.1 g

16. Which of the following can show that covalent bond is a strong bond?

A. Iodine is a solid at room temperature and pressure.
B. Iodine has a higher boiling point than helium.
C. Diamond has a high melting point.
D. Diamond cannot conduct electricity.

17. Which of the following statements about ionic compounds is/are correct?

(1) They are solids which conduct electricity.
(2) They are usually soluble in water but insoluble in non-aqueous solvents.
(3) They are malleable and ductile.

A. (1) only
B. (2) only
C. (1) and (3) only
D. (2) and (3) only

18. All of the following groups include substances with the same types of structure except

A. nitrogen, oxygen and neon.
B. chromium, manganese and iron.
C. carbon dioxide, silicon dioxide and chlorine dioxide.
D. ammonia, ethanol and methane.

19. Which of the following combinations about the structures of substances is INCORRECT?

	Substance	Structure
A.	N_2H_4	Simple molecular structure
B.	$SiCl_4$	Giant covalent structure
C.	Na/Hg	Giant metallic structure
D.	$K_3[Fe(CN)_6]$	Giant ionic structure

20. The table below lists some information about two elements *M* and *N*:

Element	**Atomic number**	**Relative atomic mass**
M	17	35.5
N	20	40.1

What is the formula mass of the compound formed between *M* and *N*?

A. 75.6
B. 111.1
C. 115.7
D. 151.2

II. Structured Questions (70 marks)

1. To investigate whether sodium and iron show similar chemical properties, a student added a piece of sodium and an iron nail to a trough of water respectively.

(a) (i) Explain why the student should not add the piece of sodium to water by hands. (1 mark)

(ii) Suggest how the student should add the piece of sodium to water. (1 mark)

(b) State TWO observable changes when sodium is added to water. (2 marks)

(c) What would be observed when a piece of pH paper is dipped into the resultant solution? (1 mark)

(d) State the observation when an iron nail is added to water. (1 mark)

(e) Do you think sodium and iron belong to the same group in the Periodic Table? Explain briefly. (2 marks)

2. Oxygen has 3 isotopes, ${}^{16}_{8}\mathrm{O}$, ${}^{17}_{8}\mathrm{O}$ and ${}^{18}_{8}\mathrm{O}$.

(a) What is the electronic arrangement of oxygen? (1 mark)

(b) Given that the relative atomic mass of oxygen is 16.0044 and the relative abundance of ${}^{16}_{8}\mathrm{O}$ is 99.76%. Calculate the relative abundance of ${}^{17}_{8}\mathrm{O}$ and ${}^{18}_{8}\mathrm{O}$ respectively. (3 marks)

(c) Explain why the three isotopes cannot be distinguished by simple chemical tests. (1 mark)

(d) State ONE use of oxygen. (1 mark)

3. The table below shows some physical properties of three chlorides (*X*Cl, YCl_3 and ZCl_5).

Chloride	Melting point (°C)	Electrical conductivity	
		At 700°C	At 850°C
*X*Cl	800.7	Poor	Good
YCl_3	–93	Poor	Poor
ZCl_5	167	Poor	Poor

(a) Explain why *X*Cl cannot conduct electricity at 700°C, but can conduct at 850°C? (2 marks)

(b) According to the information given in the table, deduce the structures of YCl_3 and ZCl_5 respectively. (2 marks)

(c) Explain the difference in melting points between YCl_3 and ZCl_5. (2 marks)

(d) YCl_3 has an octet structure. Draw the electron diagram of YCl_3, showing electrons in the outermost shells only. (1 mark)

4. Carbon dioxide extinguisher is commonly installed in the school laboratory. The metal bottle contains cold liquid carbon dioxide under high pressure.

(a) Draw the electron diagram of carbon dioxide, showing electrons in the outermost shells only. (1 mark)

(b) State the bonding and structure of liquid carbon dioxide. (2 marks)

(c) Suggest a reason why carbon dioxide extinguisher but not water extinguisher is installed in the school laboratory. (1 mark)

(d) A student suggests using helium as the extinguishing agent. Do you think this kind of fire extinguisher works? Explain. (1 mark)

5. Draw an electron diagram of the compound formed from each of the following pairs of elements (showing electrons in the outermost shells only).

(a) magnesium and oxygen (2 marks)

(b) calcium and nitrogen (2 marks)

(c) nitrogen and fluorine (2 marks)

(d) sodium and chlorine (2 marks)

6. Complete the following table on the answer sheet.

	Cation	**Anion**	**Name of the compound**	**Formula of the compound**	**Colour of the solution compound**
(a)	Ca^{2+}	$Cr_2O_7^{2-}$			
(b)			Potassium sulphate		
(c)		NO_3^-		$Zn(NO_3)_2$	
(d)				$FeCl_2$	

(14 marks)

7. Find the relative molecular mass or formula mass for each of the following substances.

(a) Br_2

(b) $Mg(NO_2)_2$

(c) $Na_2CO_3 \bullet 10H_2O$

(d) Fe_2O_3

(8 marks)

8. Complete the following table on the answer sheet by stating the structure (Giant covalent, giant ionic, simple molecular and giant metallic) for each substance belongs to. Also, state the type of attraction(s) exist(s) between particles.

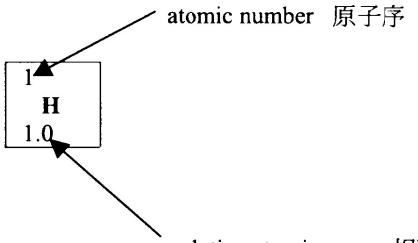
	Substance	**Type of structure**	**Type of attraction(s) between particles**
e.g.	NO_2	Simple molecular	Van der Waals' forces between NO_2 molecules Covalent bonding between N and O atoms
(a)	$MgCl_2$		
(b)	F_2		
(c)	C(diamond)		
(d)	Fe		

(14 marks)

End of Paper

PERIODIC TABLE 週期表

GROUP 族



I	II											III	IV	V	VI	VII	0
																	2 **He** 4.0
3 **Li** 6.9	4 **Be** 9.0											5 **B** 10.8	6 **C** 12.0	7 **N** 14.0	8 **O** 16.0	9 **F** 19.0	10 **Ne** 20.2
11 **Na** 23.0	12 **Mg** 24.3											13 **Al** 27.0	14 **Si** 28.1	15 **P** 31.0	16 **S** 32.1	17 **Cl** 35.5	18 **Ar** 40.0
19 **K** 39.1	20 **Ca** 40.1	21 **Sc** 45.0	22 **Ti** 47.9	23 **V** 50.9	24 **Cr** 52.0	25 **Mn** 54.9	26 **Fe** 55.8	27 **Co** 58.9	28 **Ni** 58.7	29 **Cu** 63.5	30 **Zn** 65.4	31 **Ga** 69.7	32 **Ge** 72.6	33 **As** 74.9	34 **Se** 79.0	35 **Br** 79.9	36 **Kr** 83.8
37 **Rb** 85.5	38 **Sr** 87.6	39 **Y** 88.9	40 **Zr** 91.2	41 **Nb** 92.9	42 **Mo** 95.9	43 **Tc** (98)	44 **Ru** 101.1	45 **Rh** 102.9	46 **Pd** 106.4	47 **Ag** 107.9	48 **Cd** 112.4	49 **In** 114.8	50 **Sn** 118.7	51 **Sb** 121.8	52 **Te** 127.6	53 **I** 126.9	54 **Xe** 131.3
55 **Cs** 132.9	56 **Ba** 137.3	57 * **La** 138.9	72 **Hf** 178.5	73 **Ta** 180.9	74 **W** 183.9	75 **Re** 186.2	76 **Os** 190.2	77 **Ir** 192.2	78 **Pt** 195.1	79 **Au** 197.0	80 **Hg** 200.6	81 **Tl** 204.4	82 **Pb** 207.2	83 **Bi** 209.0	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** (226)	89 ** **Ac** (227)	104 **Rf** (261)	105 **Db** (262)													

*	58 **Ce** 140.1	59 **Pr** 140.9	60 **Nd** 144.2	61 **Pm** (145)	62 **Sm** 150.4	63 **Eu** 152.0	64 **Gd** 157.3	65 **Tb** 158.9	66 **Dy** 162.5	67 **Ho** 164.9	68 **Er** 167.3	69 **Tm** 168.9	70 **Yb** 173.0	71 **Lu** 175.0
**	90 **Th** 232.0	91 **Pa** (231)	92 **U** 238.0	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** (260)