PP-DSE
CS (CHEM)
SECTION A

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION

PRACTICE PAPER

COMBINED SCIENCE — CHEMISTRY

(1 hour 40 minutes)

This paper must be answered in English

GENERAL INSTRUCTIONS

1. There are **TWO** sections, A and B, in this Paper. You are advised to finish Section A in about 30 minutes.

2. Section A consists of multiple-choice questions in this question paper, while Section B contains conventional questions printed separately in Question-Answer Book **B**.

3. Answers to Section A should be marked on the Multiple-choice Answer Sheet while answers to Section B should be written in the spaces provided in Question-Answer Book **B**. **The Answer Sheet for Section A and the Question-Answer Book for Section B will be collected separately at the end of the examination.**

4. A Periodic Table is printed on page 16 of Question-Answer Book **B**. Atomic numbers and relative atomic masses of elements can be obtained from the Periodic Table.

5. The question paper for Section A will be collected at the end of the examination.

INSTRUCTIONS FOR SECTION A (MULTIPLE-CHOICE QUESTIONS)

1. Read carefully the instructions on the Answer Sheet. After the announcement of the start of the examination, you should first stick a barcode label and insert the information required in the spaces provided. No extra time will be given for sticking on the barcode label after the 'Time is up' announcement.

2. When told to open this book, you should check that all the questions are there. Look for the words '**END OF SECTION A**' after the last question.

3. All questions carry equal marks.

4. **ANSWER ALL QUESTIONS.** You are advised to use an HB pencil to mark all the answers on the Answer Sheet, so that wrong marks can be completely erased with a clean rubber. You must mark the answers clearly; otherwise you will lose marks if the answers cannot be captured.

5. You should mark only **ONE** answer for each question. If you mark more than one answer, you will receive **NO MARKS** for that question.

6. No marks will be deducted for wrong answers.

This section consists of 24 multiple-choice questions. Choose the best answer for each question.

Candidates may refer to the Periodic Table printed on page 16 of Question-Answer Book B.

1. Element **X** occurs in nature in two isotopes, $^{69}\mathbf{X}$ and $^{71}\mathbf{X}$. The table below lists the relative abundance of each isotope:

Isotope	Relative abundance (%)
$^{69}\mathbf{X}$	60.0
$^{71}\mathbf{X}$	40.0

What is the relative atomic mass of **X** ?

A. 69.6
B. 69.8
C. 70.0
D. 70.2

2. Which of the species shown below does NOT follow the 'octet rule' ?

A. Na_2O
B. MgO
C. PCl_3
D. SCl_4

3. Which of the following species is NOT an appropriate example for illustrating dative bond formation ?

A. NH_3
B. NH_4^+
C. BF_4^-
D. BF_3NH_3

4. Which of the following statements about silicon dioxide is correct ?

A. It consists of discrete molecules.
B. It melts upon heating in a test tube.
C. It is ductile.
D. It is a poor conductor of electricity.

5. Which of the following processes is endothermic ?

   A. $H_2O(\ell) \rightarrow H_2O(s)$
   B. $CuSO_4(s) + 5H_2O(\ell) \rightarrow CuSO_4 \cdot 5H_2O(s)$
   C. $2H_2O(\ell) \rightarrow 2H_2(g) + O_2(g)$
   D. $Ca(s) + 2H_2O(\ell) \rightarrow Ca(OH)_2(aq) + H_2(g)$

6. **X**, **Y** and **Z** are three different metals. When these metals are placed separately into an aqueous solution of tin(II) nitrate, a spongy layer of tin is formed only on **X**. When each of the oxides of these metals is heated strongly, only the oxide of **Y** gives a metallic lustre. Which of the following represents the arrangement of these metals in decreasing order of reactivity ?

   A. **X > Y > Z**
   B. **X > Z > Y**
   C. **Y > X > Z**
   D. **Z > X > Y**

7. A scientist extracted a sample of 'nitrogen' from air by removing the oxygen and carbon dioxide. The scientist then compared the mass of a known volume of the 'nitrogen' sample (m_1) with that of the same volume of pure nitrogen (m_2) under the same set of conditions. The experiment was repeated a number of times. It was found that m_1 was consistently greater than m_2 .

   Which of the following gases is likely to be present in the 'nitrogen' obtained to account for the result that m_1 is greater than m_2 ?

   A. neon
   B. argon
   C. methane
   D. water vapour

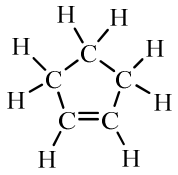
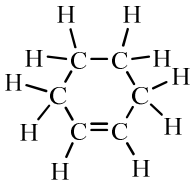
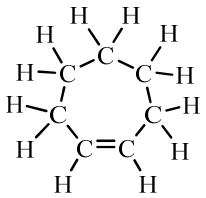
8. At 298 K, the pH of 0.10 mol dm^{-3} HCl(aq) is 1. Which of the following statements is correct ?

   A. At 298 K, the pH of 0.20 mol dm^{-3} HCl(aq) is 2.
   B. At 298 K, the pH of 0.20 mol dm^{-3} HCl(aq) is 0.5.
   C. At 298 K, the pH of 0.01 mol dm^{-3} HCl(aq) is 2.
   D. At 298 K, the pH of 0.01 mol dm^{-3} HCl(aq) is 0.1.

9. When 25 cm^3 of 1.00 mol dm^{-3} NaOH(aq) is mixed with 25 cm^3 of 1.00 mol dm^{-3} HCl(aq), the temperature of the mixture rises by 6°C. Which of the following reactants, when mixed under the same conditions, would give a similar temperature rise ?

   A. 25 cm^3 of 2.00 mol dm^{-3} NaOH(aq) and 25 cm^3 of 2.00 mol dm^{-3} HCl(aq)
   B. 50 cm^3 of 1.00 mol dm^{-3} NaOH(aq) and 50 cm^3 of 1.00 mol dm^{-3} HCl(aq)
   C. 50 cm^3 of 0.50 mol dm^{-3} NaOH(aq) and 50 cm^3 of 0.50 mol dm^{-3} HCl(aq)
   D. 100 cm^3 of 0.25 mol dm^{-3} NaOH(aq) and 100 cm^3 of 0.25 mol dm^{-3} HCl(aq)

10. The structures of three cycloalkenes are shown below:

Cycloalkenes can be represented by a general formula. Which of the following is the general formula for cycloalkenes ? (In these formulae, n is an integer greater than 2.)

A. C_nH_{2n-4}
B. C_nH_{2n-2}
C. C_nH_{2n}
D. C_nH_{2n+2}

11. The equation below represents the cracking of a hydrocarbon:

$$C_{22}H_{46} \rightarrow C_{14}H_{30} + 2\mathbf{X}$$

What is the chemical formula of compound **X** ?

A. C_3H_6
B. C_4H_8
C. C_8H_{16}
D. $C_{14}H_{28}$

12. Consider the standard enthalpy changes of the following reactions:

$I_2(s) + Cl_2(g) \rightarrow 2ICl(s)$ $\quad \Delta H^{\ominus} = +14$ kJ mol^{-1}

$ICl(s) + Cl_2(g) \rightarrow ICl_3(s)$ $\quad \Delta H^{\ominus} = -88$ kJ mol^{-1}

What is the standard enthalpy change of formation of $ICl_3(s)$?

A. –81 kJ mol^{-1}
B. –74 kJ mol^{-1}
C. +74 kJ mol^{-1}
D. +81 kJ mol^{-1}

13. 10 cm^3 of 0.25 mol dm^{-3} calcium nitrate solution is mixed with 40 cm^3 of 0.10 mol dm^{-3} nitric acid. What is the concentration of nitrate ions in the resulting solution ?

A. 0.18 mol dm^{-3}
B. 0.13 mol dm^{-3}
C. 0.080 mol dm^{-3}
D. 0.050 mol dm^{-3}

14. Consider the following chemical equation:

$$p\mathrm{SO_2(aq)} + q\mathrm{Ce^{4+}(aq)} + r\mathrm{H_2O}(\ell) \rightarrow p\mathrm{SO_4^{2-}(aq)} + q\mathrm{Ce^{3+}(aq)} + 2r\mathrm{H^+(aq)}$$

(Ce is the chemical symbol for cerium.)

Which of the following combinations is correct ?

	p	***q***	***r***
A.	1	1	1
B.	1	1	2
C.	1	2	2
D.	2	1	2

15. Which of the following statements best describes metallic bonding ?

A. It is an attractive force between ions.
B. It is an attractive force between molecules.
C. It is an attractive force between atomic nuclei and bond-pair electrons.
D. It is an attractive force between cations and delocalised electrons.

16. Which of the following gases is least soluble in water ?

A. $H_2(g)$
B. $O_2(g)$
C. $CO_2(g)$
D. $NH_3(g)$

17. Ethyne, HC≡CH, is a hydrocarbon. Which of the following statements about ethyne is INCORRECT ?

A. It is a gas at room temperature and pressure.
B. It burns with a yellow flame.
C. It undergoes addition with bromine under suitable conditions.
D. It is an alkene.

18. Barium (Ba) is an element in Group II of the Periodic Table. Which of the following is/are the observation(s) when a small piece of barium is added to a trough of water containing a few drops of phenolphthalein ?

(1) A colourless gas is liberated.
(2) The piece of barium floats on the water surface.
(3) The resulting solution in the trough is colourless.

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

19. Which of the following reagents would undergo neutralisation with limewater ?

(1) HCl(aq)
(2) $Na_2SO_4(aq)$
(3) $SO_2(g)$

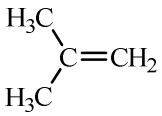
A. (1) only
B. (2) only
C. (1) and (3) only
D. (2) and (3) only

20. A salt has the formula $(NH_4)_2SO_4 \cdot FeSO_4 \cdot 6H_2O$. Which of the following is/are the expected observation(s) when an aqueous solution of this salt is treated with aqueous sodium hydroxide solution ?

(1) formation of a dirty green precipitate
(2) formation of a brown precipitate
(3) evolution of a gas with a pungent odour

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

21. Consider the following organic compound:



Which of the following statements about this compound is/are correct ?

(1) Its systematic name is 1,1-dimethylethene.
(2) It can decolourise an acidified solution of potassium permanganate.
(3) It is the monomer of Perspex.

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

22. Consider the electrolysis experiments using the following combinations of electrolyte solution, anode and cathode:

	Electrolyte solution	Anode	Cathode
(1)	copper(II) sulphate solution	copper	copper
(2)	copper(II) chloride solution	graphite	graphite
(3)	potassium sulphate solution	platinum	platinum

In which of these experiments will the concentration of the electrolyte solution remain UNCHANGED ?

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

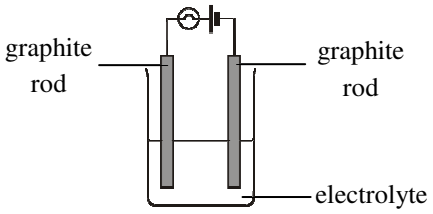
23. Which of the following statements about lithium-ion batteries is/are correct ?

(1) In lithium-ion batteries, the electrolyte is a lithium salt in water.
(2) Lithium-ion batteries are rechargeable.
(3) The disposal of lithium-ion batteries causes less harm to the environment than that of nickel-cadmium batteries.

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

24. Which of the following methods can be used to distinguish between 0.1 mol dm^{-3} HCl(aq) and 0.1 mol dm^{-3} CH_3CO_2H(aq) ?

(1) Add magnesium ribbon of the same length to each solution and compare the rate of evolution of gas bubbles.
(2) Add 10 cm^3 of 0.1 mol dm^{-3} NaOH(aq) to 10 cm^3 of each solution and compare the temperature change.
(3) Use each solution as electrolyte in the set-up shown on the right and compare the brightness of the bulb.



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

END OF SECTION A

PP-DSE
CS (CHEM)
SECTION B

B

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Candidate Number

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION

PRACTICE PAPER

COMBINED SCIENCE — CHEMISTRY

SECTION B : Question-Answer Book B

This paper must be answered in English

INSTRUCTIONS FOR SECTION B

(1) After the announcement of the start of the examination, you should first write your Candidate Number in the space provided on Page 1 and stick barcode labels in the spaces provided on Pages 1, 3, 5 and 7.

(2) Refer to the general instructions on the cover of the Question Paper for Section A.

(3) Answer ALL questions. Write your answers in the spaces provided in this Question-Answer Book. Do not write in the margins. Answers written in the margins will not be marked.

(4) An asterisk (*) has been put next to the question where effective communication is assessed.

(5) Supplementary answer sheets will be provided on request. Write your candidate number, mark the question number box and stick a barcode label on each sheet, and fasten them with string INSIDE this Question-Answer Book.

(6) No extra time will be given to candidates for sticking on the barcode labels or filling in the question number boxes after the 'Time is up' announcement.

Answer **ALL** questions. Write your answers in the spaces provided.

1. An experiment on the preparation of hydrated zinc sulphate involves the following five steps:

Step 1: Warm 30 cm^3 of dilute sulphuric acid in a beaker. Add zinc oxide to the acid until in excess.

Step 2: Filter the reaction mixture and collect the filtrate.

Step 3: Heat the filtrate until it becomes saturated. Then allow it to cool to room temperature to crystallise out hydrated zinc sulphate.

Step 4: Filter off the crystals formed, and then wash them with a little amount of cold distilled water.

Step 5: Dry the crystals.

(a) For Step 1,

(i) write the chemical equation for the reaction that occurs,

(ii) suggest how one can know that zinc oxide is in excess, and

(iii) explain why zinc oxide rather than sulphuric acid is used in excess.

(3 marks)

(b) Suggest ONE way to show that a saturated solution has been obtained in Step 3.

(1 mark)

(c) Explain why **a little amount of cold distilled water** is used to wash the crystals in Step 4.

(2 marks)

Answers written in the margins will not be marked.

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Please stick the bar here.

1. (d) Suggest ONE way of drying the crystals in Step 5.

(1 mark)

(e) Suggest ONE chemical that can be used to replace zinc oxide in this experiment.

(1 mark)

Answers written in the margins will not be marked.

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2. (a) Wine in an opened bottle will become unpalatable if left to stand for some time. Suggest is so.

(1 mark)

(b) One common way of preserving wine in an opened bottle is to inject argon, a gas which is chemically unreactive, into the bottle and then stopper the bottle.

(i) Explain why argon is chemically unreactive.

(ii) State the principle behind the use of argon in preserving wine.

(iii) Helium gas is also chemically unreactive. Suggest why helium is NOT used for preserving wine in an opened bottle.

(3 marks)

(c) Another way of wine preservation involves pumping air out from an opened bottle of wine and then stoppering the bottle. Suggest ONE possible drawback of preserving wine in this way.

(1 mark)

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Answers written in the margins will not be marked.

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3. (a) Nitrogen reacts with magnesium to give magnesium nitride (Mg_3N_2).

(i) Draw the electron diagram of magnesium nitride, showing electrons in the *outermost shells* only.

(ii) Magnesium nitride reacts with water to give magnesium hydroxide and ammonia.

Write the chemical equation for this reaction. Explain whether or not this reaction is a redox.

(3 marks)

(b) Consider the nitrogen compound NCl_3 .

(i) Draw the electron diagram of NCl_3 , showing electrons in the *outermost shells* only.

(ii) NCl_3 reacts with water to give ammonia and hypochlorous acid (HOCl).

Write the chemical equation for this reaction. Explain whether or not this reaction is a redox.

(3 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

4. A student was given a sample of a water-soluble metal carbonate, $\mathbf{M}_2CO_3(s)$. In order to deduce what **M** was, the student prepared a 100.0 cm^3 aqueous solution of the carbonate using 1.14 g of the sample. The student then withdrew several 10.0 cm^3 portions of the solution, and titrated each portion with 0.085 mol dm^{-3} HCl(aq) using methyl orange as indicator. The mean titre was 25.30 cm^3.

(a) Describe how the 100.0 cm^3 aqueous solution was prepared.

(3 marks)

(b) State the colour change at the end-point of the titration.

(1 mark)

(c) Based on the experimental results, determine the formula mass of $\mathbf{M}_2CO_3$ and deduce what **M** is.

(4 marks)

Answers written in the margins will not be marked.

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Please stick the bar here.

Answers written in the margins will not be marked.

5. The fuel used in the torch for the Beijing 2008 Olympic Games was an alkane **X** with the following composition by mass:

C, 81.8%; H, 18.2%

(a) Deduce what **X** could be.

(3 marks)

(b) Suggest an industrial process for obtaining **X.**

(1 mark)

(c) Kerosene was once used as a fuel for the Olympic torch. State ONE advantage of using each of the following substances as fuel for the torch.

(i) **X**

(ii) kerosene

(2 marks)

Answers written in the margins will not be marked.

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6. The table below lists some information about six hydroxy compounds **A**, **B**, **C**, **D**, **E** and **F**:

Compound	Structural formula	Boiling point at 1 atm / ^{o}C	Density at 20^{o}C / g cm^{-3}
A	CH_3OH	65	0.7914
B	CH_3CH_2OH	78	0.7893
C	$CH_3CH_2CH_2OH$	97	0.8035
D	$CH_3CH(OH)CH_3$	82	0.7855
E	$HOCH_2CH_2CH_2OH$	213	1.0597
F	$HOCH_2CH(OH)CH_2OH$	290	1.2613

(a) Give the systematic name of **D**.

(1 mark)

(b) Account for the variation in boiling points of **A**, **B** and **C**.

(2 marks)

(c) Explain why the density of **C** is greater than that of **D**.

(2 marks)

Answers written in the margins will not be marked.

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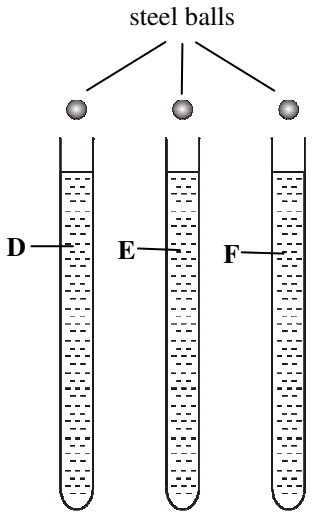
Answers written in the margins will not be marked.

6. *(d) Three identical steel balls are added separately to three identical vertical glass tu containing the same volume of **D**, **E** and **F** as shown in the diagram below.



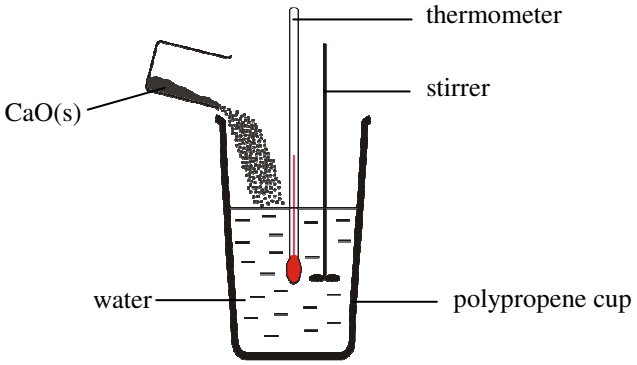
The time for the balls to reach the bottom of the tubes is in the order : **D < E < F**. Account for this observation. (You are required to consider the intermolecular attraction forces involved.)

Marker's Use Only	C

(3 marks)

Answers written in the margins will not be marked.

7. (a) A student carried out an experiment to determine the enthalpy change of the reaction of oxide with water. The set-up used is shown in the diagram below:



The experimental results are as follows:

mass of CaO(s) used	= 3.0 g
volume of water in the cup	= 50.0 cm^3
initial temperature of water in the cup	= 28.2°C
highest temperature attained by the $Ca(OH)_2(aq)$ formed	= 46.7°C

(i) Calculate the enthalpy change, in kJ mol^{-1}, of the reaction of calcium oxide with water under the conditions of the experiment.
(Assume: density of water is 1.0 g cm^{-3} and specific heat capacity of the $Ca(OH)_2(aq)$ formed is 4.2 J $g^{-1}K^{-1}$;
the polypropene cup, thermometer and stirrer used all have negligible heat capacity.)

(ii) According to the literature, $\Delta H^{\ominus}$ for this reaction is –82.2 kJ mol^{-1}. Suggest ONE reasonable explanation for the discrepancy between the literature value and the value obtained in (i).

(5 marks)

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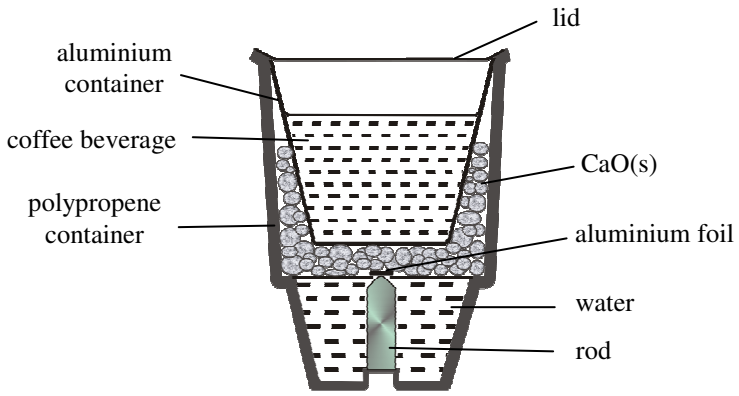
Answers written in the margins will not be marked.

7. (b) The diagram below shows the design of a can of self-heating coffee beverage. When th of the can is pushed, the rod will pierce the aluminium foil and cause mixing of the wat calcium oxide. The coffee beverage in the can will then be heated up.



(i) With reference to the properties of the materials involved, explain why

(I) a polypropene container is used to contain the calcium oxide, and

(II) an aluminium container is used to contain the coffee beverage.

(ii) Suggest ONE reasonable explanation for using calcium oxide in this type of self-heating beverage can.

(4 marks)

Answers written in the margins will not be marked.

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8. The photograph below shows a laptop computer which is powered by Direct Methanol Fuel Cell (

The operation of DMFC is based on the following reaction under an acidic condition:

$$2CH_3OH(aq) + 3O_2(g) \rightarrow 2CO_2(g) + 4H_2O(\ell)$$

(a) Write half-equations for the anodic and cathodic reactions when DMFC is producing a current.

anodic reaction

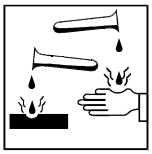
cathodic reaction

(2 marks)

(b) A concentrated aqueous methanol solution is used as the fuel in DMFC.

(i) Suggest why pure methanol is NOT used.

(ii) Circle TWO of the following hazard warning labels that should be displayed on the container of a concentrated aqueous methanol solution.



CORROSIVE 腐蝕性

TOXIC 有　毒

FLAMMABLE 易　燃

OXIDISING 氧化性

(2 marks)

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8. (c) Would you expect DMFC to be widely used in powering laptop computers ? Exp
answer.

(2 marks)

END OF PAPER

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PERIODIC TABLE 周期表

GROUP 族

atomic number 原子序

relative atomic mass 相對原子質量

I	II											III	IV	V	VI	VII	0
				1 **H** 1.0													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)