

Name : \_\_\_\_\_ (      )

Class : 3E1



# GreenRidge Secondary School

## End-of-Year Examination 2001

**Subject : Chemistry (5068)**  
**Secondary Three Express**

Date : 18 Oct 2001

Duration : 2 h 15 mins

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### INSTRUCTIONS TO CANDIDATES

Write your name, index number and class in the spaces at the top of this page and on all separate answer paper used.

**HAND UP YOUR ANSWERS TO EACH SECTION SEPARATELY.**  
**DO NOT STAPLE THEM TOGETHER.**

#### Section A

There are **25** questions in this section. Answer **all** questions.

Choose the one you consider correct and record your choice in soft 2B pencil on the OMR sheet.

#### Section B

Answer **all** questions. Write your answers in the spaces provided on the question paper.

#### Section C

Answer **any 3** questions. Write your answers on the separate foolscap paper provided. All essential working must be shown.

### INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

A copy of the Periodic Table is printed on page 18.

Graph paper is provided for question C4.

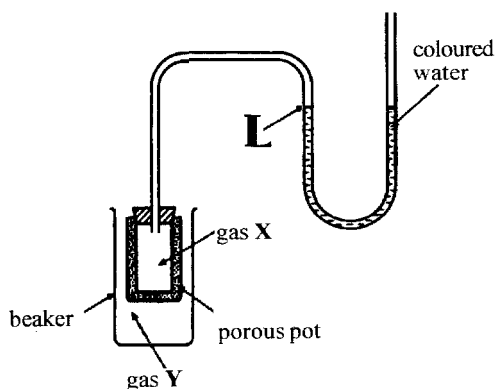
FOR EXAMINER'S USE	
Section A	/25
Section B	/45
Section C	/30
Total	/100

*This paper consists 18 printed pages, including this page.*

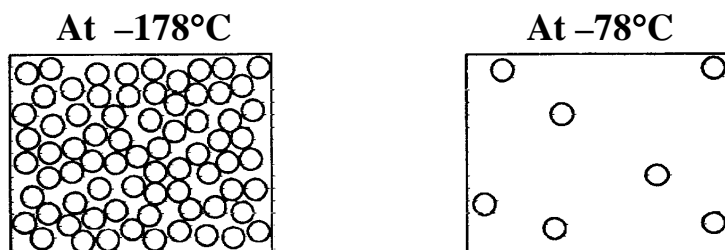
### Section A [25 marks]

Do ALL questions from Section A on the OMR sheet provided.

1. The apparatus below is used to show the diffusion of gases. Which pair of gases X and Y would cause level of the water at **L** to drop?



- |    | Gas X                         | Gas Y           |
|----|-------------------------------|-----------------|
| A. | CO <sub>2</sub>               | NO <sub>2</sub> |
| B. | CH <sub>4</sub>               | H <sub>2</sub>  |
| C. | C <sub>2</sub> H <sub>4</sub> | N <sub>2</sub>  |
| D. | CO <sub>2</sub>               | O <sub>2</sub>  |
2. The diagrams show the spacing of molecules in a substance at a pressure of 1 atm but at two different temperatures.

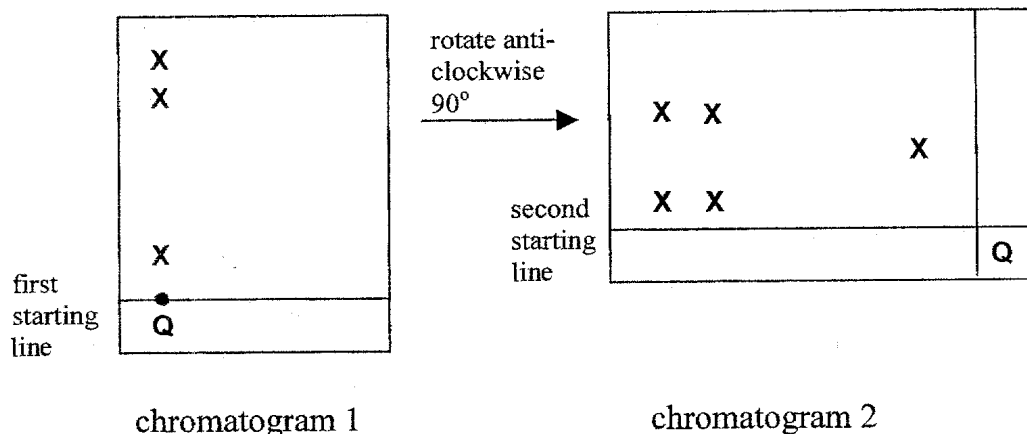


Which substance could the diagrams represent?

Substance	Melting point / °C	Boiling point / °C
A.	-208°C	-76°C
B.	-187°C	-79°C
C.	-170°C	-68°C
D.	-78°C	-0°C

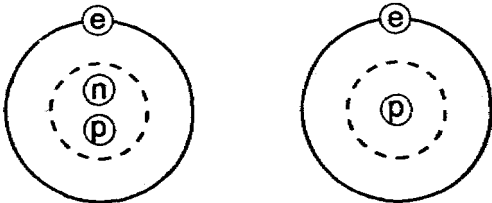
3. Which mixture can be separated by adding water, stirring and filtering?
- A. calcium carbonate and calcium chloride
  - B. copper(II) sulphate and sodium chloride
  - C. iron (III) hydroxide and copper (II) hydroxide
  - D. dilute hydrochloric acid and dilute sulphuric acid

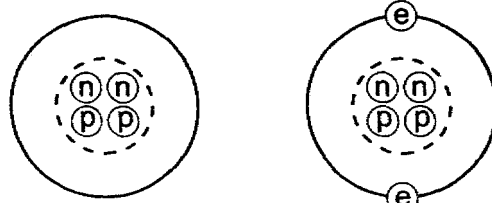
4. Chromatogram 1 below shows the separation of coloured inks in mixture Q using solvent A. Chromatogram 2 shows the separation using the same piece of paper but after it has been rotated anti-clockwise 90°C in another solvent B.

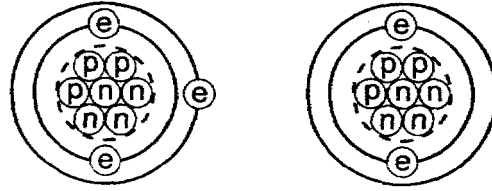


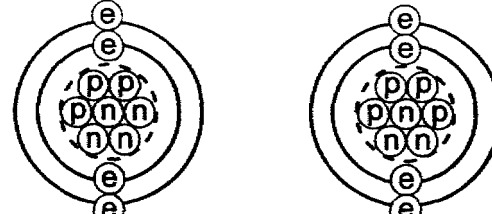
- How many different types of ink are present in mixture Q?
- A. 3  
B. 4  
C. 5  
D. 6
5. When water is heated from 30°C to 90°C, what happens to its molecules?
- I : The molecules will vibrate faster.  
II : The molecules will expand.  
III : The molecules will move further from each other.  
IV : The molecules will gain kinetic energy.
- A. I, III and IV only.  
B. II and III only.  
C. I, II and III only.  
D. III and IV only.
6. An element X has proton (atomic) number 8. Which statement about X is correct?
- A. It forms ions by gaining electrons.  
B. It is a mono-atomic gas at room temperature and pressure.  
C. It is in Group III of the Periodic Table.  
D. It is unreactive due to its stable octet structure.
7. From the following proton numbers, which pair would have similar properties?
- I : 2      II : 3      III : 12      IV : 18
- A. I and III  
B. II and III  
C. I and IV  
D. III and IV

8. Which two diagrams show two different types of atoms of the same element?

A. 

B. 

C. 

D. 

key  
 (p) = a proton  
 (n) = a neutron  
 (e) = an electron  
 ( ) = a nucleus

9. A student investigated the physical properties of certain substances. Some of the results he obtained are tabulated as follows:

<i>Substance</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
<b>Solubility in water</b>	No	Yes	Yes	No
<b>Melting point / °C</b>	437	798	500	198
<b>Electrical conductivity at room temperature</b>	Poor	Poor	Poor	Good
<b>Electrical conductivity at 600°C</b>	Good	Poor	Good	Good

Which of the above substances will form solutions that conduct electricity?

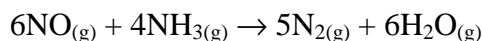
- A. 3 only
- B. 4 only
- C. 1 and 4 only
- D. 2 and 3 only

10. The table gives the numbers of protons, neutrons and electrons in particles numbered (I) to (IV).

Number of :	(I)	(II)	(III)	(IV)
Protons	17	17	20	20
Neutrons	20	18	20	21
Electrons	17	18	18	20

Which one of the following pairs of particles are likely to be found together in an ionic solid?

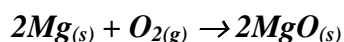
- A. (I) and (II)  
B. (I) and (III)  
C. (II) and (III)  
D. (II) and (IV)
11. One way to remove poisonous nitrogen monoxide gas (NO) from motor vehicle exhausts is to inject a stream of ammonia gas (NH<sub>3</sub>) into the exhaust vapour.



A car emits 3 dm<sup>3</sup> of nitrogen monoxide each kilometre and is driven 20 000 km a year. What volume of ammonia gas is needed each year to clean up the exhaust gas?

(All volume of gases are measured at room temperature and pressure)

- A. 20,000 dm<sup>3</sup>  
B. 40,000 dm<sup>3</sup>  
C. 60,000 dm<sup>3</sup>  
D. 80,000 dm<sup>3</sup>
12. When magnesium burns in oxygen gas, magnesium oxide forms. The chemical equation is as follows:



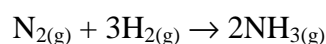
Which one of the following mixtures when burnt would leave **no** unreacted magnesium?

- A. 2.4 g of magnesium and 1.0 g of oxygen  
B. 4.8 g of magnesium and 3.2 g of oxygen  
C. 9.0 g of magnesium and 5.0 g of oxygen  
D. 48 g of magnesium and 24 g of oxygen
13. Which one of these chemicals is a common reducing agent?
- A. Acidified potassium dichromate(VI) solution  
B. Chlorine gas  
C. Iron (III) chloride solution  
D. Potassium iodide solution
14. Consider the following reactions of nitric acid. In which reaction does nitric acid act as an oxidising agent?

- A.  $\text{CuCO}_3 + 2\text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{H}_2\text{O} + \text{CO}_2$   
B.  $\text{CuO} + 2\text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{H}_2\text{O}$   
C.  $\text{Cu} + 4\text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{NO}_2 + 2\text{H}_2\text{O}$   
D.  $\text{Cu}(\text{OH})_2 + 2\text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{H}_2\text{O}$

15. Which one of the following solutions has the highest pH value?
- 50cm<sup>3</sup> of 2.0 mol/dm<sup>3</sup> of ethanoic acid
  - 50cm<sup>3</sup> of 1.0 mol/dm<sup>3</sup> of sodium hydroxide
  - 100cm<sup>3</sup> of 1.0 mol/dm<sup>3</sup> of aqueous ammonia
  - 100cm<sup>3</sup> of 2.0 mol/dm<sup>3</sup> of sulphuric acid
16. Which one of the following pairs consists of substances that produce a precipitate when their aqueous solutions are mixed?
- Barium chloride and copper (II) nitrate.
  - Lead (II) nitrate and dilute sulphuric acid.
  - Silver nitrate and potassium sulphate.
  - Zinc nitrate and sodium chloride.

17. Ammonia is manufactured by the Haber process using an iron catalyst:



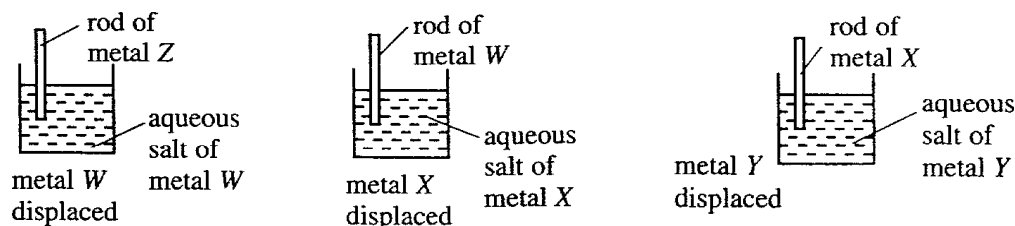
Which of the following statements is **not** correct?

- Nitrogen is reduced by hydrogen.
  - It is not possible to obtain a 100% yield of ammonia.
  - A high temperature will increase the yield of ammonia.
  - The iron catalyst is used to increase the speed of the reaction.
18. Urea, (NH<sub>2</sub>)<sub>2</sub>CO, is a commonly used fertilizer. Which of the following compounds could be added to urea to produce a suitable mixture providing the three principal elements needed for plant growth?
- phosphoric acid
  - potassium chloride
  - sodium phosphate
  - ammonium sulphate
  - aqueous ammonia
- II, III only
  - I, II and III only
  - II, III and V only
  - I, III and IV only
19. Which of the following arrangements of electrons is that of an element with the strongest oxidizing properties?
- 2,1
  - 2,7
  - 2,8,2
  - 2,8,6

20. A new element, Takenium, is found to be in Group I in the Periodic Table. Which of the following properties can be deduced from its placement in Group I?

- A. It has a melting point lower than 90°C.
- B. It will float on water.
- C. It will react violently with cold water.
- D. It will conduct electricity in solid state.

21. Three different beakers were set up as shown below.



What is the order of decreasing reactivity of the four metals?

- |    | most reactive | —————→   | least reactive |
|----|---------------|----------|----------------|
| A. | W             | X      Z | Y              |
| B. | X             | Z      Y | W              |
| C. | Z             | W      X | Y              |
| D. | Z             | Y      X | W              |

22. Reactions of three elements, X, Y, and Z, are given below.

- $X + Y \text{ nitrate} \rightarrow X \text{ nitrate} + Y$
- $Z + \text{cold water} \rightarrow \text{hydrogen gas given off}$
- $X + \text{cold water} \rightarrow \text{no reaction}$

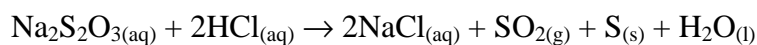
What is the order of reactivity of X, Y and Z?

- |    | most reactive | —————→ | least reactive |
|----|---------------|--------|----------------|
| A. | X             | Y      | Z              |
| B. | X             | Z      | Y              |
| C. | Z             | X      | Y              |
| D. | Y             | Z      | X              |

23. Which of the following salts **cannot** be prepared by reacting a metal with a dilute acid?

- A. Calcium chloride
- B. Iron (II) chloride
- C. Iron (III) chloride
- D. Zinc nitrate

24. In an experiment, equal volumes of 2.0 M hydrochloric acid were added to separate solutions of sodium thiosulphate,  $\text{Na}_2\text{S}_2\text{O}_3$ , in flasks. Each flask was placed over a piece of white paper marked with a cross. The precipitate of sulphur formed will obscure the cross when the cross is viewed through the solution. The time taken for the cross to disappear is noted.

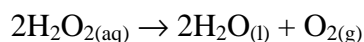


For which one of the following solutions was the time taken the longest?

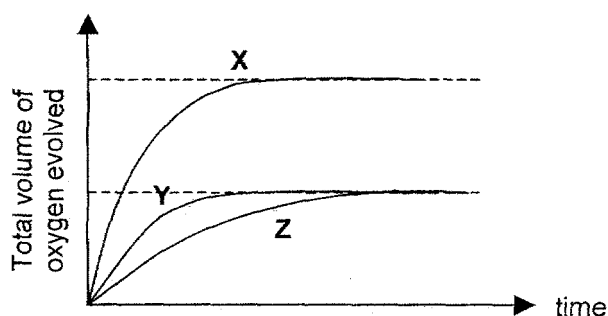
	Volume of water /cm <sup>3</sup>	Volume of $\text{Na}_2\text{S}_2\text{O}_3$ /cm <sup>3</sup>	Concentration of $\text{Na}_2\text{S}_2\text{O}_3$ /mol dm <sup>-3</sup>
A.	50	50	1.0
B.	40	60	0.5
C.	30	70	0.5
D.	20	80	0.25

*Hint : Solutions A, B, C and D are prepared by mixing different volumes of water and  $\text{Na}_2\text{S}_2\text{O}_3$  to give the final volume of 100 cm<sup>3</sup>. For example, solution A is prepared by adding 50cm<sup>3</sup> of 1.0mol dm<sup>-3</sup>  $\text{Na}_2\text{S}_2\text{O}_3$  to 50cm<sup>3</sup> of water.*

25. Hydrogen peroxide solution is catalytically decomposed by manganese(IV) oxide according to the equation below.



Three experiments were performed using different solutions but a fixed mass of catalyst. The graph shows the results.



The solutions used were:

- I 50cm<sup>3</sup> of 2.0 mol/dm<sup>3</sup> hydrogen peroxide
- II 100cm<sup>3</sup> of 1.0 mol/dm<sup>3</sup> hydrogen peroxide
- III 100 cm<sup>3</sup> of 2.0 mol/dm<sup>3</sup> hydrogen peroxide

Which curve corresponds to each solution?

	I	II	III
A.	Z	Y	X
B.	X	Z	Y
C.	Y	Z	X
D.	Z	X	Y

## Section B [45 marks]

Answer ALL questions from this Section in the spaces provided.

### Question B1 [5 mks]

<i>Fluorine</i>	<i>Oxygen</i>	<i>Tin</i>	<i>Calcium</i>
<i>Chlorine</i>	<i>Argon</i>	<i>Aluminium</i>	<i>Nitrogen</i>
<i>Hydrogen</i>	<i>Iron</i>	<i>Sodium</i>	<i>Helium</i>

Use the above list to answer the questions below. Each element can be used once, more than once, or not at all.

- (a) Two elements that form two different positive ions each [1]  
\_\_\_\_\_
- (b) Two elements which react with oxygen to form an amphoteric oxide [1]  
\_\_\_\_\_
- (c) The most reactive, non-metallic element [1]  
\_\_\_\_\_
- (d) An element that exists as diatomic molecules [1]  
\_\_\_\_\_
- (e) Two elements that react to form an ionic compound with the formula of  $X_2Y$ , where X & Y represents the respective symbols of the two elements. [1]  
\_\_\_\_\_

### Question B2 [5 mks]

One of the isotopes of an element M has a proton (atomic) number of 20 and a nucleon (mass) number of 41.

- (a) What is meant by the term isotopes? [1]

\_\_\_\_\_

\_\_\_\_\_

- (b) Complete the table about the ion of  ${}^{41}_{20}\text{M}$ . [2]

number of protons	
number of neutrons	
number of electrons	
electronic structure	

- (c) To which Group of the Periodic Table does element M belong? [1]

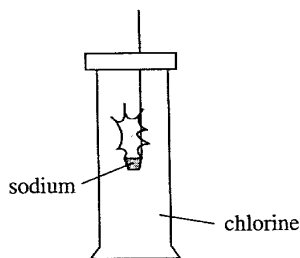
\_\_\_\_\_

- (d) M reacts with chlorine to form a white crystalline solid. What is the formula for the white crystalline solid? [1]

\_\_\_\_\_

**Question B3 [9 mks]**

When sodium burns in chlorine, sodium chloride is formed.



- (a) State **two** observations which would be made during the reaction. [2]

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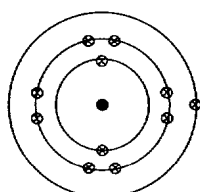
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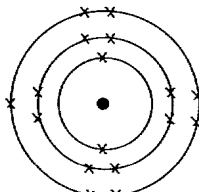
- (b) Write an equation for the reaction. [1]

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These diagrams show atoms of sodium and chlorine



sodium



chlorine

- (c) Draw similar diagrams to show the arrangement of electrons and the charges on the ions present in sodium chloride. [2]

- (d) Explain why the bonding in sodium chloride gives rise to the following properties. [2]

- (i) A very high melting point. [2]

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- (ii) High electrical conductivity when molten. [2]

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**Question B4 [5 mks]**

- (a) What is the chemical name for rust? [1]

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- (b) Explain why aluminium is more expensive than iron although aluminium is the most abundant metal in the Earth's crust. [1]

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- (c) Give three factors in which the availability of a metal depends mainly on. [3]

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**Question B5 [8 mks]**

The amount of metal ores in the Earth's crust is limited and non-renewable and there is a need for conservation and recycling of metals.

- (a) Give *three* ways of conserving metals. [3]

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- (b) Explain what is meant by the recycling of metals. [1]

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- (c) Give the importance of recycling of metals. [2]

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- (d) What are the factors that determine the choice of one metal over another for making things? [2]

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**Question B6 [4 mks]**

When magnesium metal is added to an aqueous solution of iron(III) sulphate, a redox reaction takes place. Grey crystals of iron and a colourless solution are formed.

- (a) Write the *ionic* equation, including state symbols, for the redox reaction. [2]

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- (b) Deduce which is the oxidizing agent in the reaction. Explain your answer in terms of the changes in oxidation states. [2]

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**Question B7 [4 mks]**

By means of suitable electron diagrams, illustrate the bonding in these two compounds.  
(*Show only the outer shell electrons*)

a. Ethene (C<sub>2</sub>H<sub>4</sub>) [2]

b. Carbon tetrachloride (CCl<sub>4</sub>) [2]

**Question B8 [5 mks]**

There are five elements in Group VII of the Periodic Table. The table gives some information about four of these elements.

Element	Atomic Number	Melting Point /°C	Boiling Point/ °C	Colour
Fluorine	9	-219	-188	Pale yellow
Chlorine	17		-35	Greenish yellow
Bromine	35	-7	58	Reddish brown
Iodine	53	114	183	Black

(a) Use the information in the table above to answer the following questions.

(i) Which element in Group VII is a liquid at room temperature? [1]

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(ii) **Circle** the most likely melting point of the element chlorine in °C. [1]

-101            -55            -35            0            10

(iii) The fifth element in Group VII is called astatine. Astatine has an atomic number of 85. What physical state and colour would you expect astatine to be at room temperature and pressure? [1]

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(b) What is the name given to Group VII in the Periodic Table? [1]

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(c) State one use of the element chlorine. [1]

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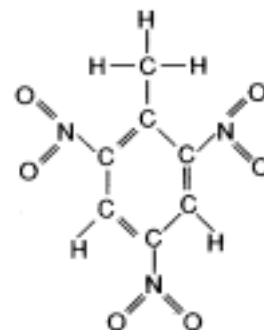
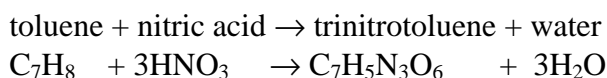
### Section C [30 marks]

Answer any **THREE** questions from this Section on foolscap papers.  
Each question is allocated **TEN** marks

#### Question C1

- (a) T.N.T. is a high explosive. It stands for tri-nitro-toluene and it burns very quickly (**17 times faster** than gunpowder) and produces vast amounts of gases. These hot gases occupy large volumes which result in an explosion outwards. High explosives like T.N.T. are used for blasting in mining and road construction as well as in general demolition work.

T.N.T. can be made by reacting toluene with concentrated nitric acid.



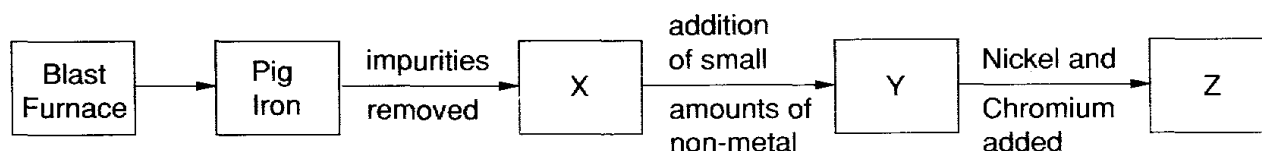
Structural formula of  
T.N.T. (tri-nitro-toluene)

- (i) Is the empirical formula of T.N.T. different from its molecular formula? [1]
- (ii) What is the relative molecular mass of T.N.T.? [1]
- (iii) How many grams would there be in 1 mole of T.N.T.? [1]
- (iv) If a factory produces 2.27 tonnes of T.N.T. per day, how many moles of T.N.T. is this? (Assume 1 tonne = 1000 kg). [1]
- (v) How many tonnes of nitric acid would be needed to produce 2.27 tonnes of T.N.T. each day? [2]
- (b) When copper(I) oxide dissolves in dilute sulphuric acid, copper(II) sulphate and copper metal are produced.
- (i) Write the balanced chemical equation for the reaction. [1]
- (ii) Discuss the changes in the oxidation states of copper in this reaction. [1]
- (iii) Is copper(I) oxide oxidised or reduced this reaction? [1]
- (iv) This reaction is called a disproportionation reaction. From your answer in (ii), deduce one characteristic feature of a disproportionation reaction. [1]

### Question C2

Iron is extracted from its ore using a Blast Furnace

- (a) (i) What is the main ore of iron called? [1]
- (ii) What is the main impurity in this ore? [1]
- (iii) Besides iron ore, which other **two** raw materials are added though the top of the furnace? [2]
- (iv) For **one** of the raw materials you mentioned in a(iii), give a reason for adding it to the Blast Furnace. [1]
- (v) Name **two** of the waste gases which escape from the top of the furnace. [1]
- (vi) In the blast furnace for the production of iron, the steel cylindrical furnace is lined with bricks made of refractory materials such as magnesium oxide.  
Which property of magnesium oxide makes it a suitable refractory material? [1]



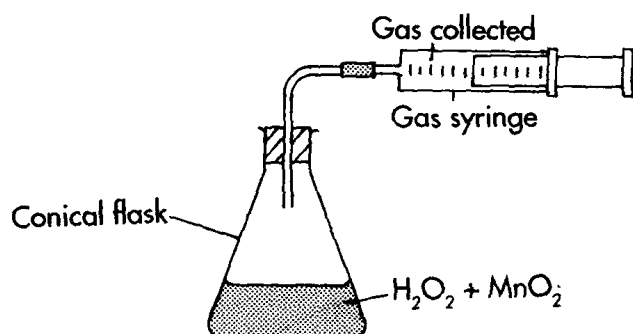
- (b) (i) Complete the above reaction scheme by identifying X, Y and Z. [2]
- (ii) Give **one** advantage of steel over pure iron. [1]

### Question C3

- (a) Sodium phosphate is the sodium salt of phosphoric acid,  $\text{H}_3\text{PO}_4$ .
- (i) What is the formula of sodium phosphate? [1]
- (ii) Give the formula of the ions present in sodium phosphate. [1]
- (b) (i) Name an alkali which reacts with phosphoric acid to give sodium phosphate. [1]
- (ii) Write a balanced equation for the reaction involving phosphoric acid and the alkali named in b(i). [1]
- (c) (i) Name a carbonate which reacts with phosphoric acid to give sodium phosphate. [1]
- (ii) Write a balanced equation for the reaction involving phosphoric acid and the carbonate named in c(i). [1]
- (d) Give **two** reasons why sodium phosphate can be used as a fertiliser. [2]
- (e) What problems may arise from the excessive use of sodium phosphate as a fertiliser? [2]

### Question C4

50 cm<sup>3</sup> of 0.5 mol/dm<sup>3</sup> aqueous hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) solution was placed in a conical flask together with 8.7g of manganese (IV) oxide (MnO<sub>2</sub>) powder. The gas produced was collected in a gas syringe as shown.



- (a) (i) Calculate the number of moles of hydrogen peroxide used in this experiment.
- (ii) How would you confirm the identity of the gas collected?
- (iii) Write down the *ionic* equation, **including state symbols**, for this reaction. [3]
- (b) The volume of gas produced was recorded every 10 seconds and the results are tabulated below.

Time /s	10	20	30	40	50	60	70	80	90	100	110
Volume of gas produced /cm <sup>3</sup>	0	90	150	200	240	260	280	295	300	300	300

- (i) Using the above results, plot the volume of gas produced against time on a piece of graph paper. Label this curve as “Expt. 1”. [2]
- (ii) The experiment was repeated using the same volume of 8.5g/dm<sup>3</sup> H<sub>2</sub>O<sub>2</sub> solution. The amount of MnO<sub>2</sub> added was also unchanged. How many moles of H<sub>2</sub>O<sub>2</sub> was used in this second experiment? [1]
- (iii) Sketch another curve (on the same piece of graph paper in (i) and using the same axes) to show the results of this second experiment. Label this second curve as “Expt. 2”. (*All volumes of gases are measured under the same conditions.*) [2]
- (c) Manganese is a transition element.
- (i) What is its oxidation state in MnO<sub>2</sub>?
- (ii) Add a third curve to the same graph showing the effect of using 17.4g of MnO<sub>2</sub> powder, all other variables being kept constant from “Expt. 1”. Label this curve as “Expt. 3”. [2]

~ The End ~

# The Periodic Table of the Elements

Group																		
I	II	III	IV	V	VI	VII	0											
		1 H Hydrogen 1																4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4							11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10					
23 Na Sodium 11	24 Mg Magnesium 12							27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18					
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 27	64 Cu Copper 29	65 Zn Zinc 30	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36		
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	101 Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 47	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54		
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	178 Hf Hafnium * 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	209 Bi Bismuth 83	207 Pb Lead 82	209 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86	
87 Fr Francium	88 Ra Radium	89 Ac Actinium	+															

\* 58 – 71 Lanthanoid series  
+ 90 – 103 Actinoid series

a	X
b	
Key	

a = relative atomic mass  
 X = atomic symbol  
 b = proton (atomic) number

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	144 Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71	
232 Th Thorium 90	232 Pa Protactinium 91	238 U Uranium 92	238 Np Neptunium 93	238 Pu Plutonium 94	242 Am Americium 95	242 Cm Curium 96	242 Bk Berkelium 97	242 Cf Californium 98	242 Es Einsteinium 99	242 Fm Fermium 100	242 Md Mendelevium 101	242 No Nobelium 102	242 Lr Lawrencium 103

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.)