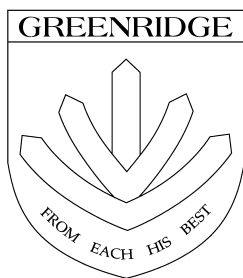


Name : \_\_\_\_\_ (      )

Class : 3E1



# GreenRidge Secondary School

## Mid-Year Examination 2001

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

Date : 15 May 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 OMR SHEET, QUESTION PAPER AND FOOLSCAP PAPER 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 14.

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

*This paper consists 14 printed pages, including this page.*

## Section A (25 marks)

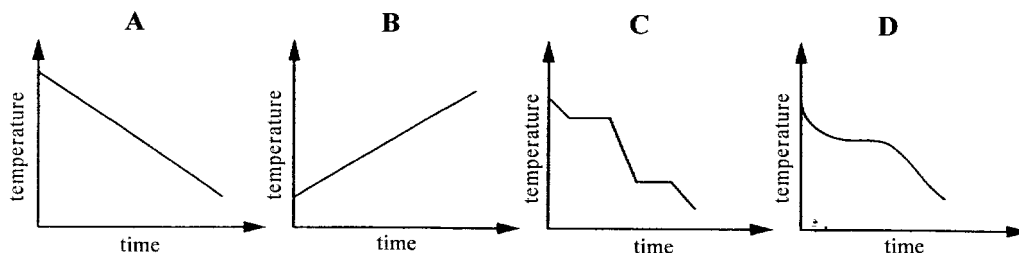
Do ALL questions from Section A on the OMR sheet provided.

- By which process does the smell of cooking spread to all the rooms in a house?
  - Decomposition
  - Diffusion
  - Evaporation
  - Convection current
- What can be deduced about two gases that have the same molecular mass?
  - They have the same solubility in water at room temperature
  - They have the same boiling point
  - They have the same number of atoms in one molecule.
  - They have the same rate of diffusion at room temperature and pressure.
- Which of the following correctly describes the particles in a dilute sugar solution at room temperature?

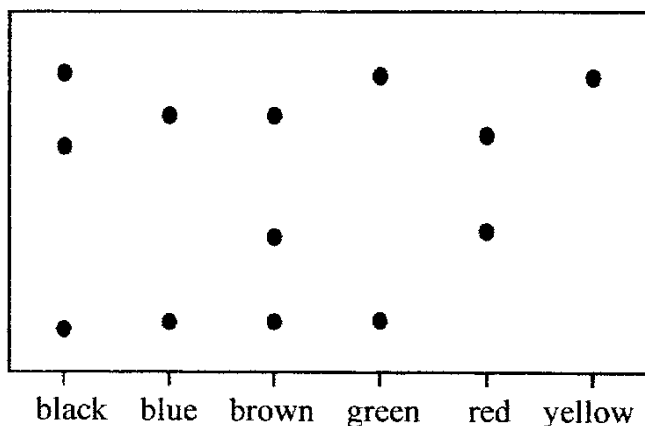
	Water molecules	Sugar molecules
A.	Widely separated, moving at random	Widely separated, moving at random
B.	Close together, moving at random	Widely separated, moving at random
C.	Widely separated, moving at random	Close together, moving at random
D.	Close together, moving at random	Close together, moving at random

- Trichloroethane is a solvent used to remove grease from clothing. How, after use, is the solvent recovered from the grease?
  - By chromatography
  - By crystallization
  - By fractional distillation
  - By filtration
- In which pair of substances is each substance a mixture?
  - Air and water
  - Lime and water
  - Quicklime and limewater
  - Sea water and air

- Which graph shows the temperature altering as steam at  $110^{\circ}\text{C}$  is cooled to  $-10^{\circ}\text{C}$ ?



7. The diagram shows a chromatogram of several inks.

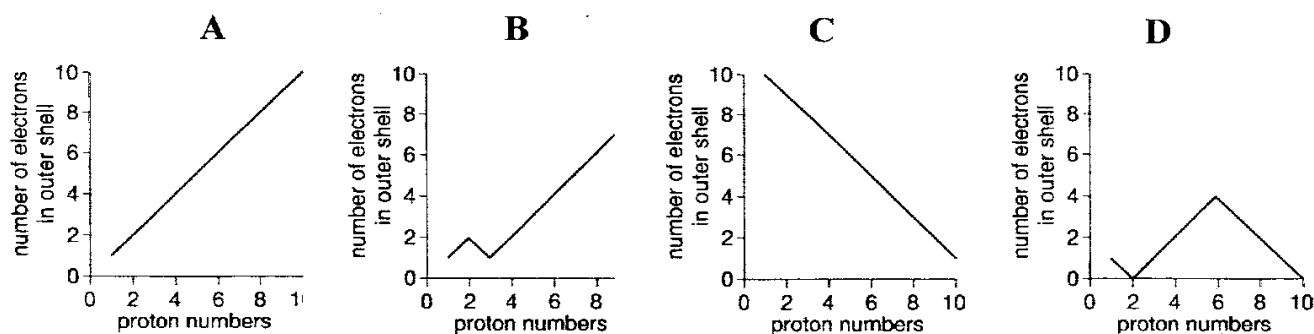


Which statement is correct?

- A. Black ink can be made by mixing green, red and yellow inks.  
 B. Brown ink can be made by mixing blue and red inks.  
 C. Yellow ink can be used to make brown ink.  
 D. Yellow ink may be present in green ink.
8. Which statement about an atom is true?  
 A. All atoms of an element have only one nucleon (mass) number.  
 B. The nucleon (mass) number can be less than the proton (atomic) number.  
 C. The nucleon (mass) number can equal the proton (atomic) number.  
 D. The number of neutrons never equals the number of electrons.
9. An atom and an ion of the isotope of sodium,  ${}_{11}^{23}\text{Na}$  both contain  
 A. 11 electrons  
 B. 12 neutrons  
 C. 23 protons  
 D. 23 neutrons
10. Elements X and Y react to form an ionic compound of formula XY. What could be the proton (atomic) numbers of X and Y?

	Element X	Element Y
A.	3	8
B.	6	8
C.	8	16
D.	12	16

11. Which graph shows the number of electrons in the outer shell of an atom, plotted against the proton (atomic) number for the first ten elements in the Periodic Table?



12. Which compound has **both** ionic and covalent bonds?

- A. Ammonium chloride
- B. Carbon dioxide
- C. Ethanol
- D. Sodium chloride

13. Which substance in the table is likely to be an ionic compound?

Substance	State at room temperature	Electrical conductivity at room temperature	Electrical conductivity of aqueous solution
A	liquid	Good	Insoluble
B	liquid	Poor	Poor
C	solid	Good	Good
D	solid	poor	Good

14. What can be deduced from the symbol  ${}^4_2\text{He}$  ?

- A. An atom of helium contains two electrons.
- B. An atom of helium has two protons and four neutrons in its nucleus.
- C. Helium has a proton (atomic) number of 4.
- D. Helium occurs as a diatomic molecule.

15. Which of the following ions has the same number of electrons as a krypton atom, atomic number 36?

- A. chloride
- B. rubidium
- C. sodium
- D. xenon

16. A solid is likely to be pure if it

- A. is neutral with a pH of 7.
- B. is crystalline with an exact melting point.
- C. melts on heating to form a colourless liquid.
- D. has a high melting point.

17. Which substance could be carbon tetrachloride ( $\text{CCl}_4$ )?

Substance	Melting Point / $^{\circ}\text{C}$	Conduction of electricity	
		When molten	In aqueous solution
A	-114	None	Good
B	-23	None	Insoluble
C	180	Good	Insoluble
D	808	Good	Good

18. Sodium chloride has a melting point as high as  $801^{\circ}\text{C}$  because

- A. there are strong electrostatic forces between the ions.
- B. it forms a giant covalent macromolecule.
- C. its ionic lattice is cubic.
- D. the crystal lattice reflects the heat.

19. Which one of these ionic substances would have the greatest electrostatic attraction between its ions?

- A. Lithium oxide
- B. Magnesium oxide
- C. Potassium chloride
- D. Sodium chloride

20. Which ion reacts with aqueous ammonia to give a precipitate that dissolves in an excess of ammonia?

- A.  $\text{Al}^{3+}(\text{aq})$
- B.  $\text{Na}^{+}(\text{aq})$
- C.  $\text{Fe}^{3+}(\text{aq})$
- D.  $\text{Zn}^{2+}(\text{aq})$

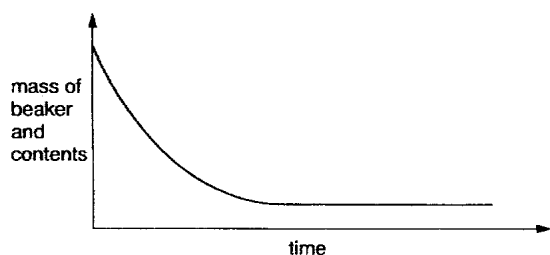
21. Aqueous sodium hydroxide reacts with a metal ion producing a coloured precipitate. This precipitate changes colour on standing. What is the ion present?

- A.  $\text{Al}^{3+}$
- B.  $\text{Cu}^{2+}$
- C.  $\text{Fe}^{2+}$
- D.  $\text{Zn}^{2+}$

22. What reacts with hydrochloric acid to give hydrogen?

- A. zinc oxide
- B. Iron
- C. Copper
- D. Sodium hydroxide

23. Two solutions are mixed in a beaker and the mass of the beaker and the contents is then recorded at various times. The graph shows the results. What could the two solutions be?

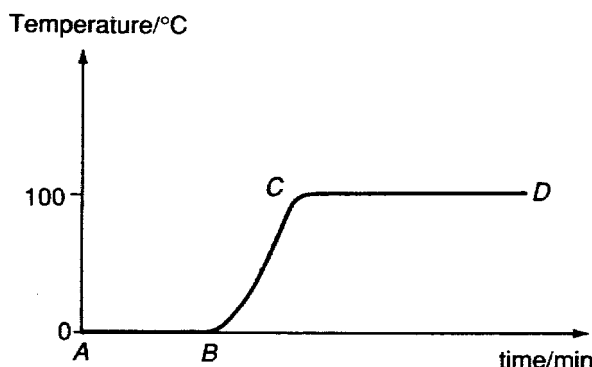


- A. Aqueous copper(II) sulphate and aqueous ammonia  
B. Aqueous sodium carbonate and dilute nitric acid  
C. Aqueous sodium hydroxide and aqueous zinc sulphate  
D. Dilute hydrochloric acid and aqueous sodium sulphate
24. Which calcium compound **does not** increase the pH of acidic soils?
- A. calcium carbonate  
B. calcium hydroxide  
C. calcium oxide  
D. calcium sulphate
25. From which mixture can the underlined substance be obtained by adding water, stirring and filtering?
- A. calcium carbonate and sodium chloride  
B. copper(II) sulphate and sodium chloride  
C. ethanoic acid and ethanol  
D. iron and magnesium

**Section B** (45 marks)

Answer **ALL** questions from this Section.

**Question 1**



A fixed mass of ice was melted and the temperature was measured at regular intervals. A graph was then plotted as shown above. Heat was supplied continuously throughout the duration of the experiment. Explain why there was no change in temperature during the intervals from A to B and C to D even though heat energy was supplied. [4]

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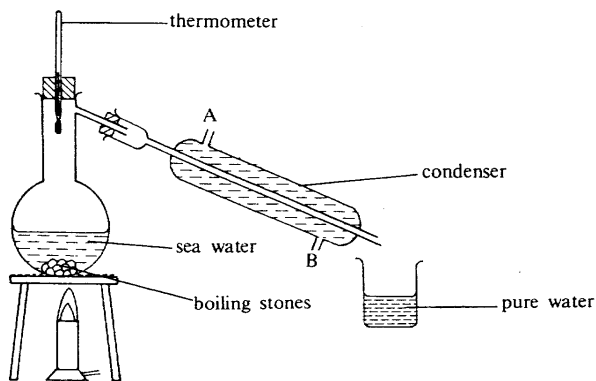
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**Question 2**

The diagram shows the apparatus used to obtain a sample of pure water from sea water. The sea water is placed in the flask and pure water is collected as shown. The experiment is then repeated to obtain a sample of pure water from tap water.



- a. What is this process called? [1]

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- b. Name one substance which is always present in sea water but not normally found in tap water. [1]  
\_\_\_\_\_
- c. Why is the flask not filled beyond the level indicated in the diagram? [2]  
\_\_\_\_\_
- d. What is the purpose of the boiling stones? [2]  
\_\_\_\_\_
- e. State whether the water enters the condenser at A or B and explain why. [2]  
\_\_\_\_\_
- f. Would the boiling point be higher for sea water or pure water? [1]  
\_\_\_\_\_

### **Question 3**

By means of suitable electron diagrams, illustrate the bonding in these **THREE** compounds.  
(Show **all** electrons shells)

- a. Magnesium chloride [2]
- b. Water [2]
- c. Calcium oxide [2]

#### Question 4

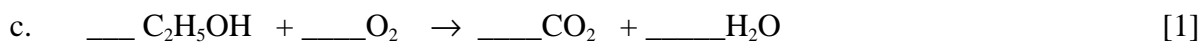
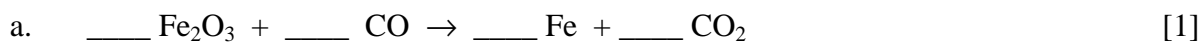
Complete the following table.

[5]

Symbol of particle	Atomic Number	Mass Number	Number of		
			Protons	Neutrons	Electrons
K <sup>+</sup>	19	39	19		
	20	40	20		18
Cl <sup>-</sup>	17		17	20	
H <sup>+</sup>	1	1	1		
C	6		6	8	

#### Question 5

Balance the following equations:



### Question 6

Write a **balanced equation** for each of the following chemical reactions:

a. copper(II) oxide + dilute sulphuric acid [2]

b. zinc + dilute hydrochloric acid [2]

c. ammonium chloride + calcium hydroxide (with heating) [2]

### Question 7

a. A mischievous boy releases a “stink-bomb” behind the class. Explain how the smell reaches the teacher standing in front of the class. [2]

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b. Smoke from a glowing joss-stick rises “lazily” into the air. Why does the smoke waft from side to side sometimes? [2]

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### Question 8

In a sample of 100 atoms of potassium there are 94 atoms of  $^{39}\text{K}$  and 6 atoms of  $^{41}\text{K}$ .

- a. Explain why these two forms of potassium are isotopes. [2]

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- b. Find the total mass of the 100 atoms of potassium. Hence find the average mass of one atom. [2]

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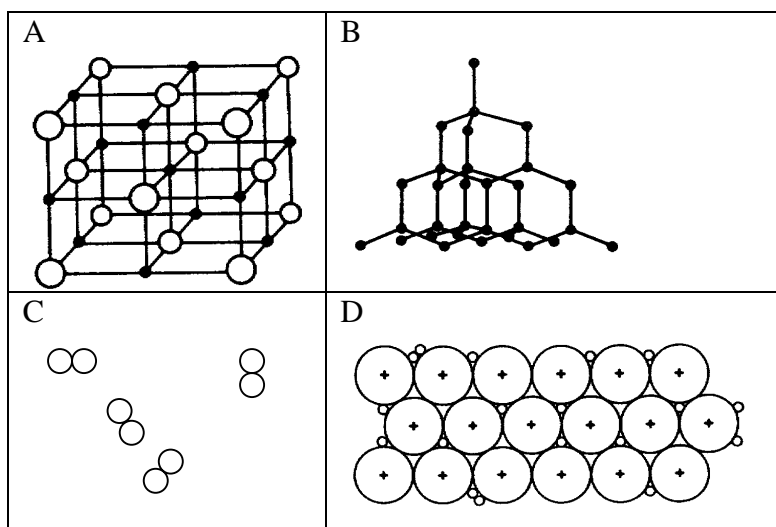
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### Question 9

The substances in the table below are to be classified according to their structures. [4]  
Choose only from the list given below. (You may use A,B,C,D,E more than once)



Substance	Write A, B, C or D
i. Diamond	
ii. Chlorine gas	
iii. Sodium chloride	
iv. Copper	

**Section C** (30 marks)

Answer **THREE** questions from this Section.

Each question is allocated **TEN** marks

**Question 1**

- a. When dilute hydrochloric acid is added to lead (II) carbonate, effervescence of a colourless gas is observed. After a short while, the reaction slows down and finally stops before the reactants were completely used up. Explain the above observation. [2]
- b. You are given 3 unlabelled bottles which contain – sodium nitrate, aluminium nitrate and zinc nitrate solution respectively. Using only sodium hydroxide solution and aqueous ammonia, describe the necessary tests that you would carry out and the observation used to identify each of them. [3]
- c. You are given four unlabelled bottles and told that each bottle has been filled with one of the following solutions: dilute nitric acid, sodium carbonate, lead (II) nitrate solution, and distilled water.

With only a number of clean empty test-tubes and beakers, describe how you would attempt to identify the solution in each bottle. You are not allowed to use any other indicators or chemicals. **(NO OTHER CHEMICALS OR FLAME IS AVAILABLE)**

Explain your tests and results clearly. [5]

**Question 2**

Copper (II) oxide is an insoluble base. Copper (II) sulphate can be made from copper (II) oxide and dilute sulphuric acid by the following procedure. Excess copper (II) oxide is added to sulphuric acid until the reaction is completed. The solution is then filtered. The clear filtrate is partly evaporated and left to cool.

- a. Explain why an excess of copper (II) oxide is used. [1]
- b. Name
- (i) the filtrate. [1]
- (ii) the residue. [1]
- c. What is the colour of the filtrate? [1]
- d. Write the balanced chemical equation for the reaction that takes place and include the state symbols. [2]
- e. Explain why the solution is partly evaporated and left to cool. [2]
- f. Can copper (II) sulphate be prepared by reacting copper metal with dilute sulphuric acid? Explain. [2]

### Question 3

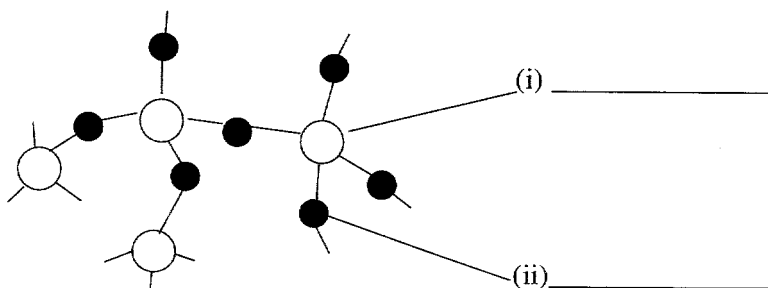
Metals consist of a **lattice of positive ions surrounded by ‘a sea of electrons’**

- a. Draw a simplified diagram to illustrate clearly the underlined statement. [2]
- b. The electrons in a metal are said to be ‘delocalized’.  
What do you understand by the term delocalized. [2]
- c. How would you describe ‘metallic bonding’? [2]
- d. Using the structure of metals mentioned above, explain why  
(i) metals are malleable, i.e. they can be hammered into different shapes  
(ii) metals are good conductors of electricity. [4]

### Question 4

Carbon and silicon are two elements which are found in Group IV of the Periodic Table. However, the oxides of both the elements have different structural properties. Carbon dioxide has a simple molecular structure whereas silicon(IV) oxide has a macromolecular structure.

- a. Draw a dot-and-cross diagram to show the bonding in a molecule of carbon dioxide. (*Show only the outermost electrons shell*) [2]
- b. The structure of silicon(IV) oxide is shown below.  
Label the two elements which it contains. [2]



- c. Explain in terms of structure why silicon(IV) oxide has a high melting point whereas carbon dioxide is a gas. [2]
- d. Name the types of particles present in the following lattices:  
(i) copper metal,  
(ii) copper (II) chloride. [2]
- e. Explain why, in the solid state, copper can conduct electricity but copper (II) chloride cannot. [2]

~ The End ~

# The Periodic Table of the Elements

Group		I	II	III	IV	V	VI	VII	0
		1 H Hydrogen							2 He Helium
3	4		5 Li Lithium		6 Be Beryllium	7	8	9	10
11	12		13 Na Sodium	14	15 Mg Magnesium	16	17	18	19
19	20		21 K Potassium	22	23 Ca Calcium	24	25	26	27
37	38		39 Rb Rubidium	40	41 Sr Strontium	42	43	44	45
55	56		57 Cs Caesium	58	59 Ba Barium	60	61	62	63
87	88		89 Fr Francium	90	91 Ra Radium	92	93	94	95
				96	97	98	99	100	101
				102	103	104	105	106	107
				108	109	110	111	112	113
				114	115	116	117	118	119
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