

NORMAN HENSILWOOD HIGH SCHOOL EXAMINATIONS



DATE	2 JUNE 2011
GRADE	10
SUBJECT	PHYSICAL SCIENCE PII
TIME	2 hours
MARKS	120
EXAMINER	G M T FEBRUARY
MODERATORS	P PRINCE & G JACOBS

Checked
26-05-2011

INSTRUCTIONS AND INFORMATION

1. Write your name and grade in the appropriate spaces on the ANSWER BOOK.
2. Answer ALL the questions.
3. This question paper consists of TWO sections:
SECTION A (25)
SECTION B (95)
4. Answer SECTIONS A and B in the ANSWER BOOK.
5. Non-programmable calculators may be used.
6. Appropriate mathematical instruments may be used.
7. Number the answers correctly according to the numbering system used in this question paper.
8. Data sheets are attached for your use.
9. Give brief motivations, discussions, et cetera where required.
10. Round off all answers correct to two decimal places where possible.

SECTION A

QUESTION 1: ONE-WORD ITEMS

Give ONE word/term for each of the following descriptions. Write only the word/term next to the question number (1.1 – 1.5) in the ANSWER BOOK.

- 1.1 A chemical reaction that causes the surroundings to heat up. (1)
- 1.2 The splitting of the nucleus. (1)
- 1.3 A substance that cannot be broken down into simpler parts. (1)
- 1.4 The compilation of all known elements. (1)
- 1.5 Two atoms that have the same number of protons, but a different number of neutrons. (1)

[5]

QUESTION 2: MULTIPLE-CHOICE QUESTIONS

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write only the letter (A – D) next to the question number (2.1 – 2.10) in the ANSWER BOOK.

- 2.1 The products formed when potassium reacts with water, are,
A $K_2O + H_2$
B $KOH + H_2$
C $KO_2 + H_2$
D $KOH + O_2$ (2)
- 2.2 A compound consists of ions X^{2+} and Y^{3-} . A possible formula for the compound could be:
A $3X2Y$
B X_2Y_3
C X_3Y_2
D $(XY)_6$ (2)

2.3 Air cannot be called an element because:

- A air can be separated into oxygen nitrogen and other gases
- B air is pure
- C air contains more than one element
- D air can be liquefied.

(2)

2.4 Which of the following is not a characteristic of a physical change:

- A no new products are formed
- B changes can be reversed
- C observable with the naked eye
- D the parts of the substance lose their chemical identity

(2)

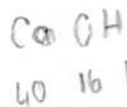
2.5 When an atom gains an electron , it forms a

- A anion
- B cation
- C molecule
- D proton

(2)

2.6 The relative formula mass of calcium hydroxide is

- A 57
- B 58
- C 97
- D 74



(2)

2.7 The outer electron structure of a Mg^{2+} is exactly the same as :

- A sodium
- B neon
- C argon
- D calcium.

(2)

- 2.8 Khumalo heats chocolate in a double boiler and observes the changes. The most accurate conclusion to his experiment is:
- A Chocolate undergoes a chemical change when it is heated
 - B Chocolate undergoes a physical change when it is heated
 - C Chocolate decomposes into its constituent components when heated
 - D Chocolate gives off latent energy when it melts. (2)
- 2.9 A certain element has a mass number of $(3x + 4)$ and an atomic number x . The number of neutrons in this atom is
- A $4x + 4$
 - B x
 - C $2x + 4$
 - D $3x + 4$ (2)
- 2.10 Heat can be transferred in different ways from a hot object to a cold object, depending on the type of substance. What is the transfer of heat called when heat from the sun is transferred through space to Earth?
- A conduction
 - B convection
 - C transpiration
 - D radiation (2)

[20]

SECTION B

INSTRUCTIONS AND INFORMATION

1. Start EACH question on a new page.
2. All sketches and general layout of your work must be neat.
3. Show the formulae and substitutions in ALL calculations.
4. Round off your numerical answers to TWO decimal places.

- 4.1 Q is the inert gas used in weather balloons. (1)
- 4.2 R is the element in period 2 that has 7 valence electrons. (1)
- 4.3 T is the element in period 3 that forms an octet. (1)
- 4.4 V is the element in period 2 that forms the V^{3-} ion. (1)
- 4.5 Y is the element in period 3 that combines with R to form the compound YR_2 . (1)
- 4.6 Z is the element in period 4 that burns with a brick red flame when it forms the Z^{+2} ion. (1)
- 4.7 P a transition element that turns green after being exposed to moisture for a while. (1)
- 4.8 M is the element in Group 2 that has electrons in two energy levels. (1)
- 4.9 W is the element in period 3 that is used in electronics. (1)
- 4.10 X is the element with the electronic structure of $1s^22s^22p^1$. (1)

[10]

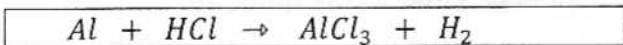
QUESTION 5

- 5.1 Define the term 'isotope' (2)
- 5.2 The mass spectrogram of magnesium shows that it has three isomers with the following compositions:
- Magnesium 24 – 80%
- Magnesium 25 – 10%
- Magnesium 26 – 10%
- 5.2.1 Write down the atomic number of magnesium in each of these isotopes (2)
- 5.2.2 Calculate the relative atomic mass of magnesium. (5)

[9]

QUESTION 6

Aluminium metal and hydrochloric acid reacts to form aluminium chloride and hydrogen gas. The unbalanced chemical equation is given below :

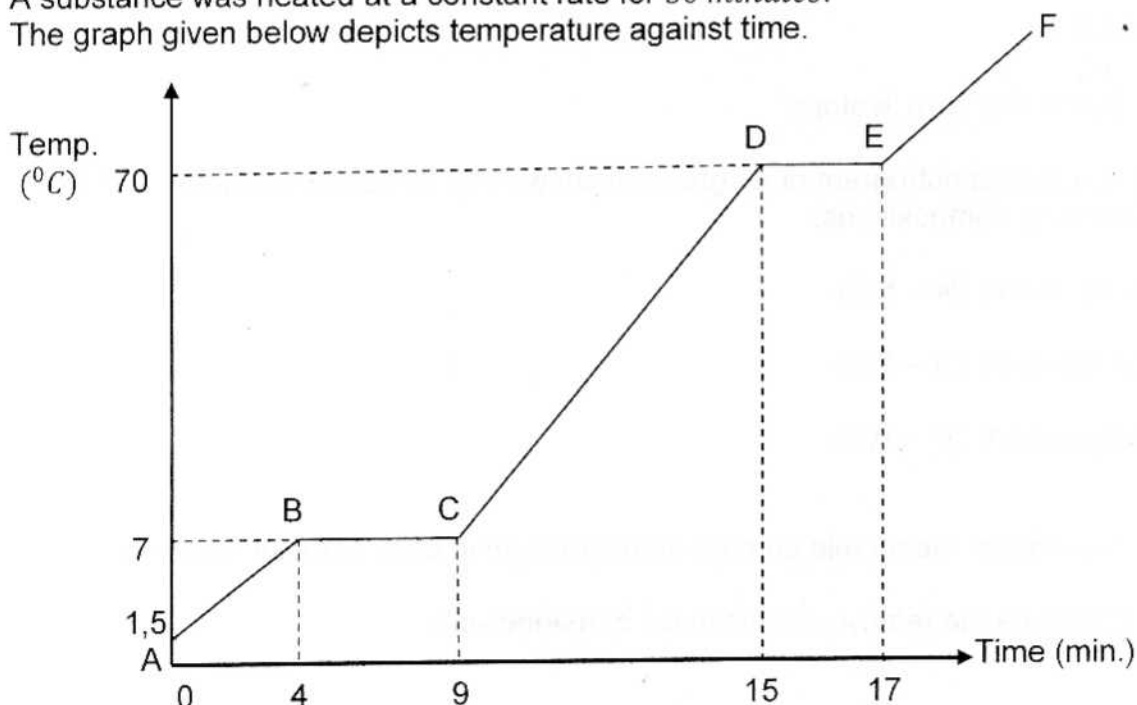


- 6.1 Balance the chemical equation for the reaction above. (4)
- 6.2 Draw an energy level diagram/ Aufbau diagram to represent Al. (3)
- 6.3 What type of bonding occurs in the formation of $AlCl_3$. (1)
- 6.4 What type of bonding occurs in the formation of H_2 . (1)
- 6.5 Use the Lewis structure to show the formation of the positive ion and negative ion when $AlCl_3$ is formed. (5)
- 6.6 Determine the percentage of chlorine in $AlCl_3$. (3)

[17]

QUESTION 7

A substance was heated at a constant rate for 30 minutes. The graph given below depicts temperature against time.

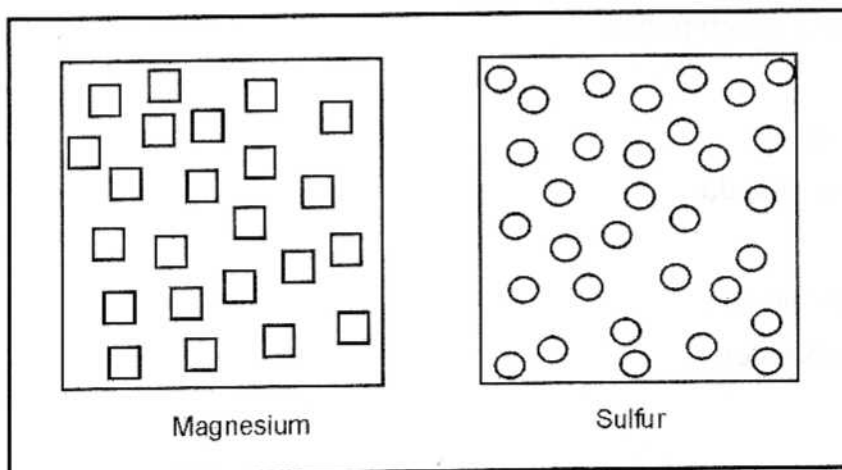


- 7.1 What was the phase of the substance at *A*? (1)
- 7.2 Describe the movement of the substance at *A* that enables it to keep the same average position. (1)
- 7.3 What is the melting point of the substance? (1)
- 7.4 What was the phase of the substance at *C*? (1)
- 7.5 Describe the movement of the substance at *C* that enables it to keep the same average position. (1)
- 7.6 What is the boiling point of the substance? (1)
- 7.7 Which phase change does *E to C* represent? (1)
- 7.8 What process is represented when the substance undergoes a phase change directly from *A to E*? (1)
- 7.9 Are the intermolecular forces *strong or weak* at *E*? (1)
- 7.10 Why is the temperature constant between *D and E*. (3)

[12]

QUESTION 8

- 8.1 Consider the diagrams of magnesium and sulfur given below. Draw two diagrams that show the difference between a MIXTURE of magnesium and sulfur and a COMPOUND of magnesium and sulfur.



(4)

8.2 For each of the mixtures appearing on the table, choose a separation technique from the following list. You want to keep all the substances in the mixture. Also provide the properties of the substances in the mixture which make the separation technique suitable. NB : Only answer the questions indicated by the letter:

Hand sorting; Magnetism; Evaporation; Filtration; Fractional distillation;
Separating funnel method; Distillation; Chromatography;

MIXTURE	SEPARATION METHOD	PROPERTIES
Water and oil	(a)	
Steel nails and copper nails (same size, painted the same colour)	(b)	
Water and alcohol	(c)	(f)
Red, pink and green Smarties	(d)	
The different colours in the dye of a red Smartie	(e)	

(6)

8.3 Consider the following household items:

- fizzy drink (e.g. cola)
- sugar crystals
- salt solution
- graphite for a clutch pencil
- vinegar
- iron paper clips
- bicarbonate of soda
- air
- dishwashing liquid
- granite counter top

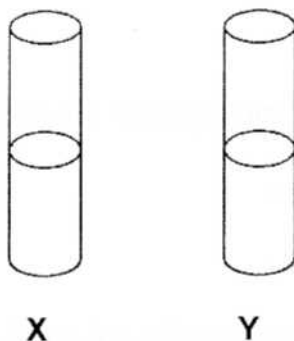
From the list of items above, write down:

- a) ONE homogeneous mixture (1)
- b) ONE heterogeneous mixture (1)
- c) TWO compounds (2)
- d) TWO elements. (2)

[16]

QUESTION 9

You are given two salts marked X and Y. Your task is to identify the name of each salt with the aid of certain information given to you.



- 9.1 Which test would conduct to find the positive ion of each salt? (1)
- 9.2 List the apparatus used to conduct the test above. (4)
- 9.3 Write down the name of the cation of each salt given the colour during the test in the table below :

	Cation	Colour
X	(a)	Bright yellow
Y	(b)	Yellow - green

*Calcium
Potassium
Copper
Barium
Sodium*

(2)

A series of tests are now conducted to identify the anion of each salt above. For each situation below identify the anion and write down the full name and chemical formula :

9.4 A solution of $BaCl_2$ is poured into test tube X and a precipitate forms which eventually dissolves when some nitric acid is poured into the test tube. (3)

9.5 A solution of $BaCl_2$ is poured into test tube Y and no precipitation forms. Xylene and some chlorine water is added to the test tube. The xylene turns purple. (3)

[13]

QUESTION 10

10.1 Write a complete balanced chemical equation for the reaction between :

10.1.1 nitric acid and calcium carbonate. (5)

10.1.2 magnesium and sulphuric acid. (4)

10.3 Draw neat Lewis structures to show the formation of water and carbon dioxide. (4)

[13]