



Province of the  
**EASTERN CAPE**  
EDUCATION

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 11**

**NOVEMBER 2010**

**PHYSICAL SCIENCES P2**

**MARKS: 150**

**TIME: 3 hours**

This question paper consists of 17 pages including an answer sheet.

NOVEMBER 2010

PHYSICAL SCIENCES P2

3

**SECTION A**

Answer this section on the attached ANSWER SHEET.

**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.

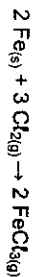
- 1.1 The chemical bond that forms when one molecule or ion donates a pair of electron to another molecule or ion or ion which has a vacant orbital in the valence shell. (1)
- 1.2 The law which states the relationship between pressure and volume of an enclosed mass of gas at constant temperature. (1)
- 1.3 The simplest mole ratio in which the elements of a compound have bonded. (1)
- 1.4 A solution whose concentration is exactly known. (1)
- 1.5 The substance that is reduced and gains electron during a redox-reaction. (1)

**QUESTION 2 MULTIPLE-CHOICE QUESTIONS**

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

- 2.1 The ability of an atom in a molecule to attract the bonding electron pair to form a polar covalent bond: (2)
- A. Ionisation energy  
B. Electronegativity  
C. Enthalpy  
D. Heat of reaction
- 2.2 The minimum energy the colliding molecules must have for a reaction to start: (2)
- A. Activation energy  
B. Ionisation energy  
C. Bond energy  
D. Lattice energy

- 2.3 Iron metal reacts with chlorine gas to form reddish brown vapours of iron(III) chloride. The balanced chemical equation is as follows:



In this reaction the oxidation number of ...

- A. iron increases and iron is reduced.  
 B.  $\text{Cl}_{2\text{(g)}}$  increases and  $\text{Cl}_{2\text{(g)}}$  is oxidised.  
 C. iron increases and Fe is oxidised.  
 D.  $\text{Cl}_{2\text{(g)}}$  increases and  $\text{Cl}_{2\text{(g)}}$  is the oxidizing agent.

(2)

- 2.4 0,1 mol of  $\text{Na}_2\text{CO}_3$  is dissolved in water and the volume is made up to 1 dm<sup>3</sup>. What is the concentration of sodium carbonate solution, sodium ions and carbonate ions?

	$\text{Na}_2\text{CO}_3$ (mol.dm <sup>-3</sup> )	$\text{Na}^+$ (mol.dm <sup>-3</sup> )	$\text{CO}_3^{2-}$ (mol.dm <sup>-3</sup> )
A.	0,2	0,1	0,1
B.	0,1	0,1	0,2
C.	0,2	0,2	0,1
D.	0,1	0,2	0,1

(2)

- 2.5 Consider the following acid-base reaction



According to the Bronsted-Lowery concept of acids and bases, in this reaction  $\text{NH}_4^+\text{(aq)}$  ...

- A. accepts a proton and acts as a base.  
 B. donates a proton and acts as a base.  
 C. accepts a proton and acts as an acid.  
 D. donates a proton and acts as an acid.

(2)

- 2.6 The number of molecules in 3 mol of  $\text{CO}_2$  gas:

- A.  $4,98 \times 10^{24}$   
 B.  $2,00 \times 10^{23}$   
 C.  $1,806 \times 10^{24}$   
 D.  $6,02 \times 10^{23}$

(2)

- 2.7 The iron ore that is most abundant which is used in the blast furnace for the extraction of iron metal is ...

- A. haematite.  
 B. dolomite.  
 C. calcite.  
 D. malachite.

(2)

- 2.8 Two different gases are kept under standard conditions of temperature and pressure. If the two gases occupy the same volume, then they will have the same ...

- A. mass.  
 B. number of molecules.  
 C. density.  
 D. atomic mass.

(2)

- 2.9 The chemical reaction in which an unsaturated hydrocarbon is converted to a saturated hydrocarbon using hydrogen gas and nickel as a catalyst:

- A. Halogenation  
 B. Hydrogenation  
 C. Hydration  
 D. Hydrohalogenation

(2)

- 2.10 The atmospheric layer in which the ozone layer is found:

- A. Troposphere  
 B. Thermosphere  
 C. Stratosphere  
 D. Ionosphere

(2)

TOTAL SECTION A: 25

SECTION B Answer this section in the ANSWER BOOK

INSTRUCTIONS AND INFORMATION

1. Start each QUESTION on a NEW page.
2. Leave one line between two subquestions, for example between QUESTIONS 3.1 and 3.2.
3. The formulae and substitutions must be shown in ALL calculations.
4. Round off your answers to TWO decimal places.

QUESTION 3 (Start on a new page)

3.1 The covalent bonds in the formation of the following compounds are drawn **INCORRECTLY**. Write down their correct Lewis structure to show the correct way in which covalent bonding takes place in these molecules.



3.2 Classify the following diatomic molecules as polar or non-polar:



3.3 Ammonia is manufactured by the Haber process according to the equation



During a chemical reaction when chemical bonds are broken energy is absorbed and when chemical bonds are formed energy is released.

3.3.1 What is the energy absorbed or released when chemical bonds are broken or formed are called? (1)

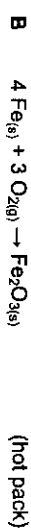
3.3.2 Using the following information in the table given below, calculate the heat of reaction ( $\Delta H$ ) for the above reaction.

N = N	H - H	N - H
941 kJ mol <sup>-1</sup>	436 kJ mol <sup>-1</sup>	389 kJ mol <sup>-1</sup>

(7)

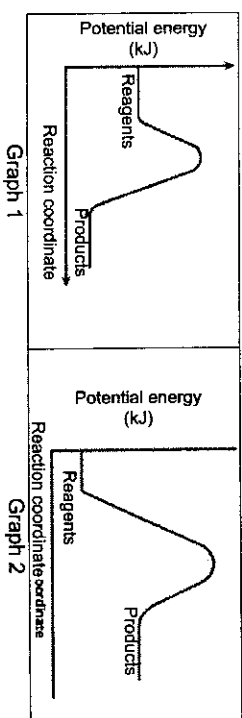
3.4 Hot and cold packs are in common use today for the treatment of injuries and reduction of swelling. Cold packs absorb heat from the surroundings to produce cooling effect. Hot packs produce instant relief for hikers and skiers especially for the treatment of pulled muscles.

The two reactions that are taking place in the cold pack and hot pack are given below labelled as A and B.



3.4.1 Write down the heat of the reaction ( $\Delta H$ ) for the above two reactions A and B indicating the correct signs. (+ve or -ve signs.) (2)

3.4.2 The potential energy versus reaction coordinate graph for the above reactions A and B is given below:

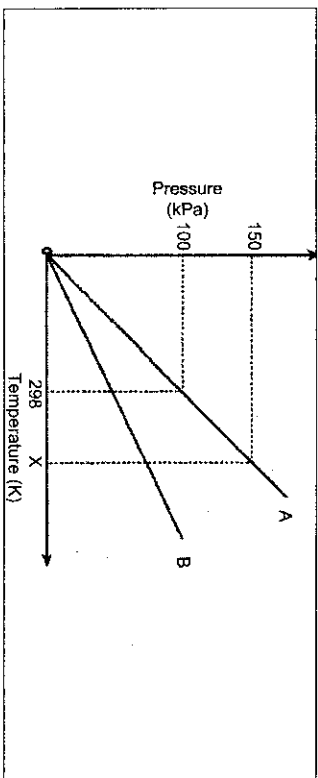


Which graph represents reaction A (Graph-1 or Graph-2)? Give a reason for your answer. (3)

[25]

**QUESTION 4** (Start on a new page)

Two learners A and B, investigate the relationship between the temperature and pressure of an enclosed mass of gas. The learners used different samples of  $\text{SO}_2(\text{g})$  in two identical containers with a fixed volume of  $1 \text{ dm}^3$ . The results obtained by the learners A and B were plotted on the same set of axes as shown below:



- 4.1 Formulate an investigative question for this investigation. (2)
- 4.2 Write down the mathematical relationship between pressure and kelvin temperature from the learners conclusion based on the graph they obtained. (2)
- 4.3 Which variable is kept constant during this investigation? (1)
- 4.4 Give an explanation for the relationship that you have written in QUESTION 4.2 using the Kinetic Theory of gases. (3)
- 4.5 Calculate the value of temperature indicated by X (in  $^{\circ}\text{C}$ ) using the information given on the graph. (6)
- 4.6 Calculate the mass of  $\text{SO}_2(\text{g})$  used by learner A. (7)
- 4.7 Write down the temperature which in degree celsius is equal to zero kelvin. What is this temperature called? (2)
- [23]

**QUESTION 5** (Start on a new page)

A dilute solution of ethanoic acid called vinegar is used daily in food industry and households. The relative molecular mass of ethanoic acid is  $60 \text{ g}\cdot\text{mol}^{-1}$ . Ethanoic acid consists of 39,9% carbon, 6,7% hydrogen and 53,4% oxygen.

- 5.1 Determine the molecular formula of ethanoic acid. (8)
- 5.2 A particular recipe for the baking of malva pudding requires 75  $\text{cm}^3$  of vinegar and 2,2g of baking soda ( $\text{NaHCO}_3$ ).
- 5.2.1 Calculate the number of moles of  $\text{NaHCO}_3$  in 2,2 g of baking soda. (3)
- 5.2.2 Is ethanoic acid a strong acid or a weak acid? Give a reason for your answer. (3)
- 5.2.3 Calculate the concentration of the vinegar used if the 75  $\text{cm}^3$  vinegar reacts completely with 60  $\text{cm}^3$  of  $\text{NaHCO}_3$  solution of concentration  $0,1 \text{ mol}\cdot\text{dm}^{-3}$ . The equation for the reaction that takes place is given below: (5)
- $$\text{CH}_3\text{COOH} + \text{NaHCO}_3 \rightarrow \text{CH}_3\text{COONa} + \text{H}_2\text{O} + \text{CO}_2$$
- [19]

## QUESTION 6 (Start on a new page)

A group of learners in a school performed the following experiments to investigate about the various type of chemical reactions. The experiment they performed, the observations made and the type of reaction based on their conclusion are entered in a tabular column as shown below

Experiment	Observations	Type of reaction
1. A clean dry strip of Zinc metal is placed in Copper sulphate solution (CuSO <sub>4</sub> ) in a small beaker.	A black substance is deposited on the surface of the zinc metal and the blue colour solution slowly fades	Addition reaction
2. H <sub>2</sub> S(g) passed through a solution of FeCl <sub>3</sub> taken in a test tube.	Yellow particles of sulphur formed.	Redox reaction
3. A piece of magnesium ribbon is placed in a test tube containing hydrochloric acid.	Bubbles of hydrogen gas formed.	Redox reaction

Answer the following questions using the above table drawn up by the learners:

- 6.1 Define a *reducing agent*. (2)
- 6.2 Write down the balanced oxidation half reaction taking place in Experiment 1. (2)
- 6.3 In Experiment 1 the oxidation number of Cu decreases from +2 to zero. Is this half reaction an oxidation or reduction reaction? (1)
- 6.4 The learners entered the type of reaction for Experiment 1 **INCORRECTLY**. Write the correct type of reaction. Write the balanced ionic equation to show how you arrived at the conclusion. (5)
- 6.5 Write down the balanced net ionic equation for the reaction taking place in Experiment 3. (3)
- 6.6 From the balanced equation in QUESTION 6.5 write down the **FORMULA** of the oxidizing agent. (1)
- 6.7 What is the oxidation number of Fe in FeCl<sub>3</sub>? (1)
- [15]

## QUESTION 7 (Start on a new page)

Cigarette lighters are filled with butane gas under pressure. Butane gas is an alkane which burns in oxygen to form heat and light energy.

- 7.1 Is the alkane butane a saturated hydrocarbon or unsaturated hydrocarbon? Give a reason for your answer. (2)
- 7.2 Write down the balanced equation for the complete combustion of butane gas in oxygen. (3)
- 7.3 What are isomers? (2)
- 7.4 Write down the structural formula of two possible isomers of butene (C<sub>4</sub>H<sub>8</sub>) and mention the IUPAC name of each of them. (6)
- 7.5 Prop-2-ene reacts with bromine water. The bromine water is decolourised by this unsaturated hydrocarbon.
- 7.5.1 Write down the balanced equation for this reaction using structural formula. (3)
- 7.5.2 Write down the IUPAC name of the saturated hydrocarbon formed. (2)
- 7.5.3 Is the reaction in QUESTION 7.5.1 an example of substitution, addition or elimination reaction? (2)
- [20]

## QUESTION 8 (Start on a new page)

The discovery of iron 3 000 years ago made a huge difference to the lives of people. Construction of buildings, manufacturing of modern weapons and utensils and the population increase put more demand for iron. Iron ore is mixed with limestone and coke in the blast furnace to produce the metal.

- 8.1 What is an ore? (2)
- 8.2 Name the gas formed when the blast of air reacts with coke and carbon dioxide at high temperature. (1)
- 8.3 Write down the balanced equation for the reaction of haematite with the gas formed in QUESTION 8.2. (3)
- 8.4 What is the role of limestone in a blast furnace? (2)
- 8.5 Write the chemical formula of the slag formed when limestone reacts with sand. (2)
- 8.6 Name TWO commercial uses of the slag formed in the blast furnace. (4)
- [14]

**QUESTION 9**

(Start on a new page)

A science learner is presenting a report about the green house effect and global warming which leads to climate change to a gathering of learners at his school. He was explaining to learners how each family is contributing to global warming through the activities that they do.

- 9.1 Briefly explain what is meant by green house effect and how it leads to global warming. (4)
- 9.2 Name THREE gases that are responsible for global warming. (3)
- 9.3 Mention TWO actions of human beings that contribute to global warming. (2)

TOTAL SECTION B: 125

GRAND TOTAL: 150

NATIONAL SENIOR CERTIFICATE  
NASIONALE SENIOR SERTIFIKAAT

DATA FOR PHYSICAL SCIENCES GRADE 11  
PAPER 2 (CHEMISTRY)

GEGEWENS VIR FISIESE WETenskapPE GRAAD 11  
VRAESTEL 2 (CHEMIE)

TABLE 1: PHYSICAL CONSTANTS/TABEL 1: FISIESE KONSTANTES

NAME/NAAM	SYMBOL/SIMBOOL	VALUE/WAARDE
Standard pressure	$p^{\ominus}$	$1,013 \times 10^5$ Pa
Standaarddruk		
Molar gas volume at STP	$V_m$	$22,4 \text{ dm}^3 \cdot \text{mol}^{-1}$
Molêre gasvolume by STD		
Standard temperature	$T^{\ominus}$	273 K
Standaardtemperatuur		

TABLE 2: FORMULAE/TABEL 2: FORMULES

$n = \frac{m}{M}$	$c = \frac{n}{V}$
$E_{\text{cell}}^{\ominus} = E_{\text{cathode}}^{\ominus} - E_{\text{anode}}^{\ominus}$	$E_{\text{cell}}^{\ominus} = E_{\text{red}}^{\ominus} / E_{\text{ox}}^{\ominus} = E_{\text{anode}}^{\ominus} - E_{\text{cathode}}^{\ominus}$
$E_{\text{cell}}^{\ominus} = E_{\text{reduction}}^{\ominus} - E_{\text{oxidation}}^{\ominus}$	$E_{\text{cell}}^{\ominus} = E_{\text{red}}^{\ominus} / E_{\text{ox}}^{\ominus} = E_{\text{reductant}}^{\ominus} - E_{\text{oxidant}}^{\ominus}$
$E_{\text{cell}}^{\ominus} = E_{\text{oxidising agent}}^{\ominus} - E_{\text{reducing agent}}^{\ominus}$	$E_{\text{cell}}^{\ominus} = E_{\text{oxidiser}}^{\ominus} / E_{\text{reducer}}^{\ominus} = E_{\text{oxidiser}}^{\ominus} - E_{\text{reducer}}^{\ominus}$