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 GRADE 11 EXAMINATIONS
 GRAAD 11-EKSAMEN

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PHYSICAL SCIENCES – SECOND PAPER (CHEMISTRY)

IXESHA: 3 iiyure
 AMANQAKU: 150

TIME: 3 hours
 MARKS: 150

TYD: 3 uur
 PUNTE: 150

*Write on the cover of your answer book, after the word "Subject" –
 PHYSICAL SCIENCES – SECOND PAPER*

*This question paper consists of 11 pages, a 4-page data sheet, an answer sheet and a
 graph paper.*

0 8 3 0 6 6

INSTRUCTIONS AND INFORMATION

1. Write your name and/or examination number (and centre number if applicable) in the appropriate spaces on the ANSWER SHEET and ANSWER BOOK.
2. Answer ALL the questions.
3. Answer SECTION A on the attached ANSWER SHEET and place the completed ANSWER SHEET inside your ANSWER BOOK.
4. Answer SECTION B in the ANSWER BOOK.
5. Non-programmable calculators may be used.
6. Appropriate mathematical instruments may be used.
7. Number the questions correctly according to the numbering system used in this question paper.
8. Data sheets and a periodic table are attached for your use.
9. Give brief motivations, discussions, et cetera where required.

0 8 3 0 6 6

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) on the attached ANSWER SHEET.

- 1.1 The minimum energy required for molecules to react. (1)
- 1.2 The reaction where the energy of the reactants is lower than the products. (1)
- 1.3 Example of a green house gas. (1)
- 1.4 A solution of which the concentration is known precisely. (1)
- 1.5 Shape of ammonia molecules. (1)

[5]

QUESTION 2: MATCHING ITEMS

Choose an item from COLUMN B that best matches a description in COLUMN A. Write only the letter (A – J) next to the question number (2.1 – 2.5) on the attached ANSWER SHEET.

COLUMN A	COLUMN B
2.1 Low activation energy	A. F
2.2 Ion in toothpaste	B. NO ₃ ⁺
2.3 Conjugate base of HNO ₃	C. stratosphere
2.4 The chlorination of methane	D. troposphere
2.5 Ozone layer	E. exothermic
	F. NO ₃ ⁻
	G. P ₃
	H. spontaneous reaction
	I. addition
	J. substitution

[5]

QUESTION 3

Indicate whether the following statements are TRUE or FALSE. Choose the answer and write TRUE or FALSE next to the question number (3.1 – 3.5) on the attached ANSWER SHEET. Correct the statements that are FALSE.

- 3.1 Alkynes undergo addition reactions. (2)
- 3.2 If zinc reacts with dilute hydrochloric acid in an open container, equilibrium is reached after a while. (2)
- 3.3 The oxidation number of S in H₂SO₄ is +4. (2)
- 3.4 A catalyst can be used to increase the rate of a reaction. (2)
- 3.5 Sun is the ultimate source of energy. (2)

[10]

QUESTION 4: 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 make a cross (X) in the correct block (A – D) next to the question number (4.1 – 4.5) on the attached ANSWER SHEET.

- 4.1 Consider the reaction:

$$\text{NH}_3 + \text{X} \rightarrow \text{NH}_4^+ + \text{OH}^-$$
 X is a / an
 A. Acid with the formula H₂O
 B. Base with the formula H₂O
 C. Base with the formula H₃O⁺
 D. Acid with the formula H₃O⁺ (3)
- 4.2 The enthalpy change of a combustion reaction is always ...
 A. negative.
 B. positive.
 C. zero.
 D. Cannot be calculated (3)
- 4.3 The CH₄ molecule is non-polar because ...
 A. It has a linear shape.
 B. The electronegativity difference is small.
 C. The molecule is non-symmetrical.
 D. The molecule is symmetrical. (3)

4.4 Consider the following reaction:



Which one of the following combinations is CORRECT?

	Oxidised	Oxidising agent
A	Fe^{2+}	Fe^{3+}
B	Fe^{3+}	Cl^-
C	Fe^{2+}	Cl_2
D	Cl_2	Cl^-

(3)

4.5 Consider equal masses of the gases below. Which ONE of these gases would occupy the smallest volume at STP?

- A. N_2
- B. CO_2
- C. CH_4
- D. SO_2

(3)
[15]

TOTAL SECTION A: 35

0 8 3 0 6 6

SECTION B

INSTRUCTIONS AND INFORMATION

1. Answer SECTION B in the ANSWER BOOK.
2. Start each question on a new page.
3. The formulae and substitutions must be shown in ALL calculations.
4. Round off your answers to TWO decimal places.

QUESTION 5

Dezi is asked to compare the properties of H_2O , CO_2 and H_2S . She obtains the following data which she uses in her study. Help her complete the table by writing down only the question number (5.1 – 5.5) and the answer.

Name	H_2O Water	H_2S 5.1	CO_2 Carbon dioxide
Melting point (°C)	0	-85.6	
Boiling point (°C)	100	-60.7	
Sublimation point (°C)			-78
Electronegativity difference	1.4	0.4	5.2
Phase at room temperature	5.3	Gas	Gas
Molecular polarity	Polar Covalent	5.4	
Intermolecular forces	5.5	Van der Waals – Dipole-Dipole Forces	

(5)

5.6 Draw the Lewis structure for the molecule H_2S . (3)

5.7 Using the information obtained above, Dezi has to come to a conclusion concerning the strengths of the intermolecular forces that exist between the molecules of each of the substances above. Write down the molecules in ascending order of the strengths of the intermolecular forces. (3)

(3)
[11]

QUESTION 6

A certain liquid is a raw material in the manufacture of compounds such as medicines, dyes and explosives. A sample of 10 g of this liquid is analyzed and it is established that the sample consists of the following:

- 9.23 g carbon
- 0.77 g hydrogen

- 6.1 Determine the empirical formula of this liquid. (4)
- 6.2 Determine the molecular formula of the liquid if its molar mass is 78 g.mol⁻¹. (3)

[7]

QUESTION 7

A cooldrink company usually uses a hot air balloon suspended in the air to advertise their product. They use helium gas to fill these balloons. Sello sees such a balloon in East London and now he decides to do an investigation about the volume and temperature of helium at a constant pressure. He then tabulated his results as follows:

VOLUME in cm ³	TEMPERATURE in K
96	288
100	300
110	330
120	360
125	375

- 7.1 Formulate a possible investigative question for the investigation. (2)
- 7.2 Write down a possible hypothesis for the investigation. (2)
- 7.3 Choose suitable scales for the axes (V on the y-axis and T on the x-axis) and draw a graph of V vs T on the graph paper that is provided. (5)
- 7.4 Use your graph to explain to Sello what the mathematical relationship between volume and temperature of a gas is. (3)
- 7.5 Give a reason why Sello uses helium gas instead of oxygen. (2)
- 7.6 On the graph in QUESTION 7.3, indicate how the graph will differ if oxygen was used instead of helium. Mark this change as A. (2)

[16]

QUESTION 8

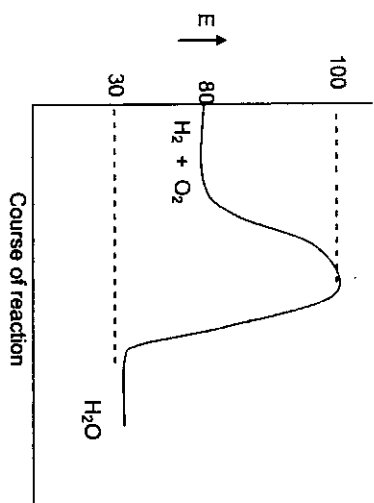
When a bond is formed between atoms, energy is released. The same amount of energy will be required to break the bond. This is a measure of the bond strength. The average bond dissociation energy required to dissociate each bond in a molecule is called bond energy or bond enthalpy. Study the equation for the reaction given below and answer the following questions:



Given that bond energies of the following:

- H – H = 436 kJ.mol⁻¹
- O = O = 499 kJ.mol⁻¹ and
- O – H = 460 kJ.mol⁻¹

- 8.1 Name the type of bonds that must be broken for the above reaction to take place. (2)
- 8.2 Using the bond energies given, calculate the total energy needed to break the bonds in the above reaction. (5)
- 8.3 Calculate the value of ΔH for the conversion of hydrogen and oxygen to water from the following diagram: (4)



[11]

QUESTION 9

Butane is one example of a chemical substance which is commonly used during combustion in order to benefit people. The following equation can be used to represent the combustion of butane:



- 9.1 How does butane benefit people? (2)
- 9.2 Balance the given equation. (2)
- 9.3 Does butane act as a reducing agent or an oxidizing agent? (2)

The alkanes like hexane is used as fuel/petrol in cars:

- 9.4 What impact does the use of leaded fuel have on the human health? (2)
- 9.5 What new type of fuel (besides unleaded) was introduced in South Africa in 2006 to cater for cars with engines that were not compatible with unleaded petrol? (2)

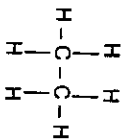
[11]

QUESTION 10

10.1 Most areas in the Free State grow sunflowers. Most of the sunflower seeds are used to produce oil. The catalytic hydrogenation of the sunflower oil produces a substance which most households use in preparation for their meals.

- 10.1.1 Name the food product formed when sunflower oil reacts with hydrogen. (2)
- 10.1.2 Is the reaction in QUESTION 10.1.1 an addition, substitution or elimination reaction? (2)

10.2 Ethane, C₂H₆, has the following structural formula



- 10.2.1 Using structural formulae, write down an equation to show how ethene can be formed from ethane. (3)
- 10.2.2 What type of reaction is shown in QUESTION 10.2.1? (2)
- 10.2.3 What can be observed when bromine is added to ethene? (2)

[11]

QUESTION 11

According to South African Bureau of Standards (SABS) commercial vinegar must contain at least 4,0% ethanoic acid which corresponds to a concentration of 0,67 mol.dm⁻³. A group of learners, as part of their practical investigation, decides to do a titration to find the concentration of a particular brand of vinegar that they bought from a shop and to investigate whether it complies with the required standards.

To do the titration, they prepare a 250 cm³ standard solution of NaOH of concentration 0,1 mol.dm⁻³ in a standard flask. It is found that during the titration 10,2 cm³ of NaOH reacted with 5 cm³ of the vinegar sample used.

The balanced chemical equation for the reaction is as follows:



- 11.1 Write down an investigative question for this investigation. (2)
- 11.2 Calculate the concentration of vinegar using 5 cm³ of the vinegar sample. (7)
- 11.3 Write down the conclusion for this investigation. (2)

[11]

QUESTION 12

Rusting of iron (Fe) is an oxidation process. This results when air and water attack the surface of a metal. When iron rusts, a flaky brownish substance is formed. The equation for the reaction is:



- 12.1 Define oxidation. (2)
- 12.2 Balance the above equation. (2)
- 12.3 Name the oxidizing agent in the above equation. (2)
- 12.4 Write down question numbers 12.4.1 and 12.4.2 in the answer book and next to it the oxidation number of the oxygen atom in each of the following: (2)

Compound	O ₂	Fe ₂ O ₃
Oxidation number	12.4.1	12.4.2

- 12.5 Name TWO ways to prevent the process of rusting? (4)

[12]

0 8 3 0 6 6

QUESTION 13

Greenhouse gases are released into the atmosphere and they form a blanket around the earth. We know that the earth is heated up by radiation from the sun. Upon reaching the atmosphere, some of this short-wavelength radiation is reflected back into space. Some is absorbed by the atmosphere in the conversion of ozone and the rest is transmitted through the atmosphere to the surface of the Earth.

- 13.1 Give THREE gases, other than CO₂, that are responsible for global warming. (3)
- 13.2 Mention TWO activities of human society that contribute to global warming. (2)
- 13.3 What is the greenhouse effect? (2)
- 13.4 Give ONE negative effect (consequence) of global warming. (2)
- 13.5 Name TWO advantages of greenhouse gases. (2)
- 13.6 Give TWO ways which might reduce the emission of greenhouse gases. (2)
- 13.7 What are the nations of the world doing to prevent global warming? (2)

[15]

QUESTION 14

The smelting of iron ore is done at very high temperatures in a blast furnace. The two important ores of iron are haematite and magnetite which are iron oxides. Coke, a form of carbon and limestone, and iron ore are fed from the top of the furnace and heated up. The carbon from coke combines with the oxygen from the iron ore to form carbon monoxide gas. Carbon monoxide reduces iron oxide to iron. Limestone helps to remove impurities like silicon dioxide as slag. The molten iron is then refined to remove most of the carbon to get pig iron.

- 14.1 Write the formula of haematite ore. (2)
- 14.2 What is the function of CO in the blast furnace? (2)
- 14.3 Write a balanced chemical equation for the reduction of iron oxide to iron by carbon monoxide. (3)
- 14.4 What is the environmental impact of mining and refining of iron? (3)

[10]

TOTAL SECTION B: 115

GRAND TOTAL: 150

**GRADE 11
GRADE 11**

**DATA FOR PHYSICAL SCIENCES GRADE 11
PAPER 2 (CHEMISTRY)**

**GEGEWENS VIR FISIËSE WETENSKAPE GRAAD 11
VRAESTEL 2 (CHEMIE)**

TABLE 1: PHYSICAL CONSTANTS/TABEL 1: FISIËSE KONSTANTES

NAME/NAAM	SYMBOL/SIMBOOL	VALUE/WAARDE
Standard pressure	p°	1,013 x 10 ⁵ Pa
Standarddruk		
Molar gas volume at STP	V _m	22,4 dm ³ · mol ⁻¹
Molêre gasvolume by STD		
Standard temperature	T°	273 K
Standardtemperatuur		

TABLE 2: FORMULAE/TABEL 2: FORMULES

$n = \frac{m}{M}$	$c = \frac{N}{V}$
$E^{\ominus}_{cell} = E^{\ominus}_{cathode} - E^{\ominus}_{anode} / E^{\ominus}_{cell} = E^{\ominus}_{oxidation} - E^{\ominus}_{reduction}$	$E^{\ominus}_{cell} = E^{\ominus}_{reduction} - E^{\ominus}_{oxidation} / E^{\ominus}_{cell} = E^{\ominus}_{cathode} - E^{\ominus}_{anode}$
$c = \frac{m}{MV}$	$E^{\ominus}_{cell} = E^{\ominus}_{oxidising agent} - E^{\ominus}_{reducing agent} / E^{\ominus}_{cell} = E^{\ominus}_{oxidising agent} - E^{\ominus}_{reducing agent}$