Province of the
EASTERN CAPE
EDUCATION

Iphondo leMpuma Kapa: Isebe leMfundo
Provinsie van die Oos Kaap: Department van Onderwys
Porafensie Ya Kapa Botjahabela: Lefapha la Thuto

NATIONAL SENIOR CERTIFICATE

GRADE 11

NOVEMBER 2025

PHYSICAL SCIENCES P2 (CHEMISTRY)

MARKS: **150**

TIME: **3 hours**

This question paper consists of 21 pages, including 4 data sheets.

INSTRUCTIONS AND INFORMATION

1. Write your name and surname in the appropriate space on the ANSWER BOOK.
2. This question paper consists of NINE questions. Answer ALL the questions in the ANSWER BOOK.
3. Start EACH question on a NEW page in the ANSWER BOOK.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave ONE line between two sub questions, e.g. between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable calculator.
7. You may use appropriate mathematical instruments.
8. Show ALL formulae and substitutions in ALL calculations.
9. Round off your FINAL numerical answers to a minimum of TWO decimal places.
10. Give brief motivations, discussions, etc. where required.
11. You are advised to use the attached DATA SHEETS.
12. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question numbers (1.1 to 1.10) in the ANSWER BOOK, for example 1.11 E.

1.1 Which ONE of the following molecules contains a dative covalent bond?

A H_2O

B NH_3

C BF_3

D NH_4^+ (2)

1.2 Consider the chemical bonds shown below:

C – C	C = C	C ≡ C

Which ONE of the following combinations regarding the bond length and bond energy is CORRECT?

	SHORTEST BOND LENGTH	HIGHEST BOND ENERGY
A	C – C	C – C
B	C = C	C = C
C	C ≡ C	C ≡ C
D	C – C	C ≡ C

(2)

1.3 Which ONE of the following substances have ION DIPOLE FORCES between its molecules?

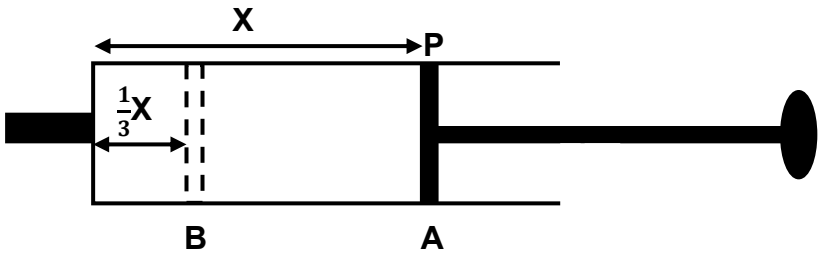
A H_2O (ℓ)

B CO_2 (g)

C NaCℓ (aq)

D NaCℓ (s) (2)

1.4 The diagram below shows a gas syringe containing a certain gas. When the plunger is at position **A** the volume occupied by the gas is **X** and exerts a pressure **P**. When the plunger moves to position **B** the volume occupied by the gas is $\frac{1}{3}$ **X**.



What is the DIFFERENCE in pressure exerted by the gas between points **A** and **B**?

A 3 **P**

B $\frac{2}{3}$ **P**

C $\frac{1}{3}$ **P**

D 2 **P** (2)

1.5 Consider the following statement regarding the activated complex during a chemical reaction:

(I) The activation energy must be overcome to reach the activated complex.

(II) It is the unstable transition state from reactants to products.

(III) It is the energy released or absorbed during a chemical reaction.

Which of the above statement(s) is/are CORRECT about the activated complex?

A **II** and **III** only

B **II** only

C **I** and **II** only

D **I** only (2)

1.6 Consider the balanced equation:

$$Na_2CO_3\,(aq) + 2\,HC\ell\,(aq) \rightarrow 2\,NaC\ell\,(aq) + H_2O\,(\ell) + CO_2\,(g)$$

1 mol of Na_2CO_3 reacts with 1 mol of $HC\ell$ to yield 0,2 mol of CO_2.

Which ONE of the following combinations is CORRECT regarding the reaction?

	Limiting reagent	**% yield of CO_2**
A	Na_2CO_3	40%
B	Na_2CO_3	20%
C	$HC\ell$	40%
D	$HC\ell$	20%

(2)

1.7 Consider the incomplete equation below:

$$H_2\mathbf{Y} + 2\,NaOH \rightarrow Na_2\mathbf{Y} + 2\,H_2O$$

The formula of **Y** is …

A $C\ell^-$

B SO_4^{2-}

C NO_3^-

D PO_4^{3-}

(2)

1.8 Consider the following equation:

$$(COOH)_2\,(aq) + H_2O\,(\ell) \rightleftharpoons (COO)_2^{2-}\,(aq) + H_3O^+\,(aq)$$

The bases in the above reaction are …

A $(COOH)_2$ and H_2O

B $(COO)_2^{2-}$ and H_3O^+

C H_2O and $(COO)_2^{2-}$

D $(COOH)_2$ and $(COO)_2^{2-}$

(2)

1.9 Consider the reaction below:

$$5\ Zn + 2\ MnO_4^- + 16\ H^+ \rightarrow 5\ Zn^{2+} + 2\ Mn^{2+} + 8\ H_2O$$

The reducing agent in the above reaction is …

A Zn

B MnO_4^-

C H^+

D Mn^{2+} (2)

1.10 How many electrons are needed to reduce 2 mol of H_2O to 2 mol of OH^- and 1 mol of H_2?

A 2

B 3

C 4

D 5 (2)

[20]

QUESTION 2 (Start on a new page.)

Consider the following substances (**A**–**D**) in the table below:

SUBSTANCE	CHEMICAL FORMULA
A	HOCℓ
B	NF_3
C	H_2S
D	HCN

2.1 Define the term *chemical bond*. (2)

2.2 Draw the Lewis structures for the following molecules.

2.2.1 HOCℓ (2)

2.2.2 HCN (2)

2.3 Write down the name of the molecular shape for:

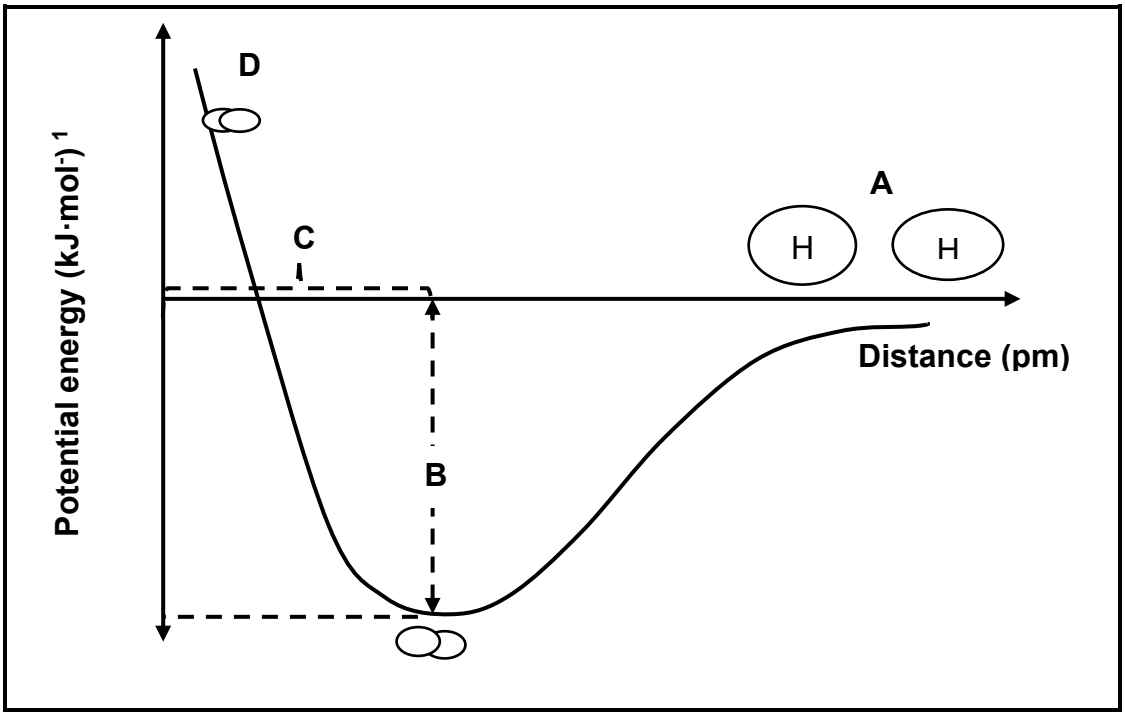
2.3.1 H_2S (1)

2.3.2 NF_3 (1)

2.4 Is NF_3 a POLAR or NON-POLAR molecule?

Fully explain the answer. (4)

2.5 Two hydrogen atoms form a bond according to the energy profile graph shown below.



Use the letters **A**, **B**, **C** or **D** as it appears on the graph above to identify the following:

2.5.1 Bond energy (1)

2.5.2 Point when repulsive forces are stronger than the attractive forces (1)

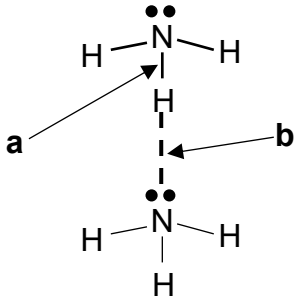
2.5.3 Explain the formation of H_2 from the graph.

Refer to the electrostatic force between the protons and electrons and energy involved. (2)

[16]

QUESTION 3 (Start on a new page.)

3.1 The diagram below is used to demonstrate the differences between intermolecular forces and intramolecular forces (chemical bonds) between two NH_3 molecules.



3.1.1 Write down the name of the predominant intermolecular force that is represented by letter **(b)** in the diagram above. (1)

3.1.2 Write down TWO requirements for the formation of the force named in QUESTION 3.1.1. (2)

3.1.3 Write down the name of bond labelled **(a).** (1)

3.1.4 Which ONE (**a** or **b**) requires the highest amount of energy to break/overcome its forces? (1)

3.2 Consider the boiling points of the hydrogen halides on group 16 as shown on the table below.

Hydrogen halides		Boiling point (°C)
A	H_2S	- 60
B	H_2Se	- 41
C	H_2Te	- 2

3.2.1 Define the term *boiling point*. (2)

3.2.2 Write down the phase of the hydrogen halides at room temperature. (1)

3.2.3 Explain the trend observed in the boiling points of the hydrogen halides by referring to the molecular size and energy involved. (3)

3.2.4 Which hydrogen halide (H_2S, H_2Se or H_2Te) will have the lowest vapour pressure at a certain temperature?

Give a reason for the answer. (2)

3.2.5 How will the boiling point of HF compare to that of H_2S?

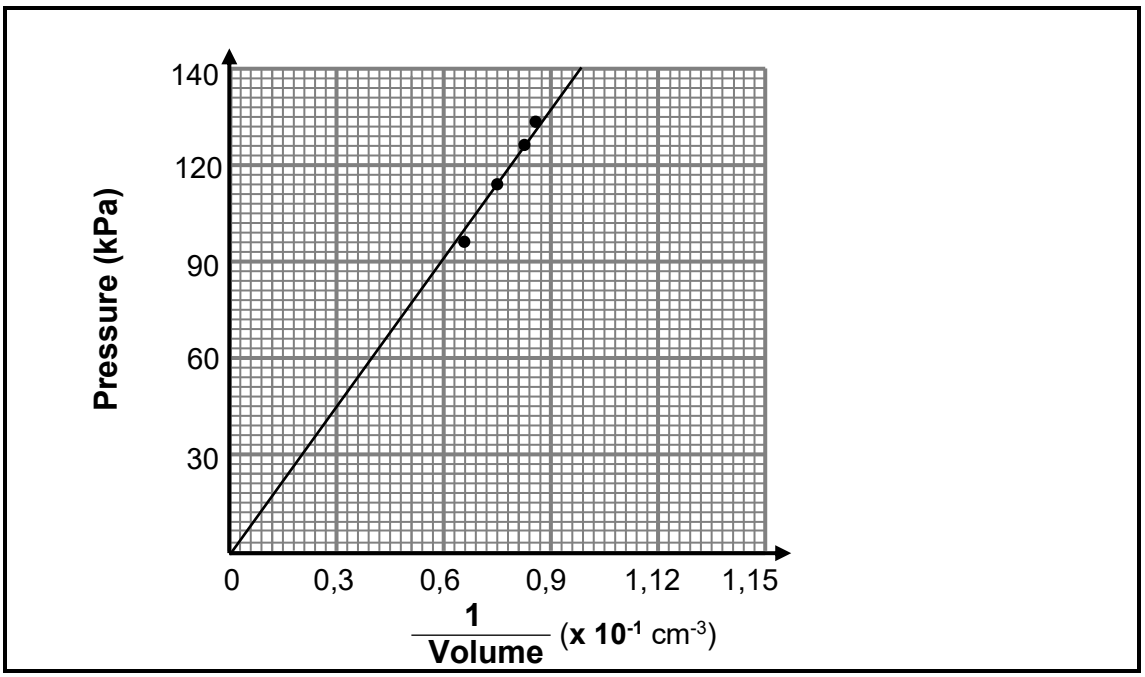
Choose from HIGHER THAN, LOWER THAN or EQUAL TO. (1)

3.2.6 Explain the answer in QUESTION 3.2.5 by referring to type of intermolecular forces and energy involved. (4)

[18]

QUESTION 4 (Start on a new page.)

A group of learners investigated the relationship between the pressure and volume of a certain gas. The graph of the pressure versus inverse of volume was obtained from the data in the investigation.



4.1 Name the gas law that is investigated. (1)

4.2 From the investigation write down:

4.2.1 An investigative question for this investigation (2)

4.2.2 TWO controlled variables for this investigation (2)

4.3 Explain the relationship observed between pressure and volume by referring to the kinetic molecular theory. (3)

4.4 Determine the volume that the gas occupied at 96 kPa. (2)

4.5 Calculate the volume occupied by the gas at 252 kPa. (4)

4.6 It is observed that the gas does not obey the gas law named in QUESTION 4.1 at very high pressure. Explain this observation. (3)

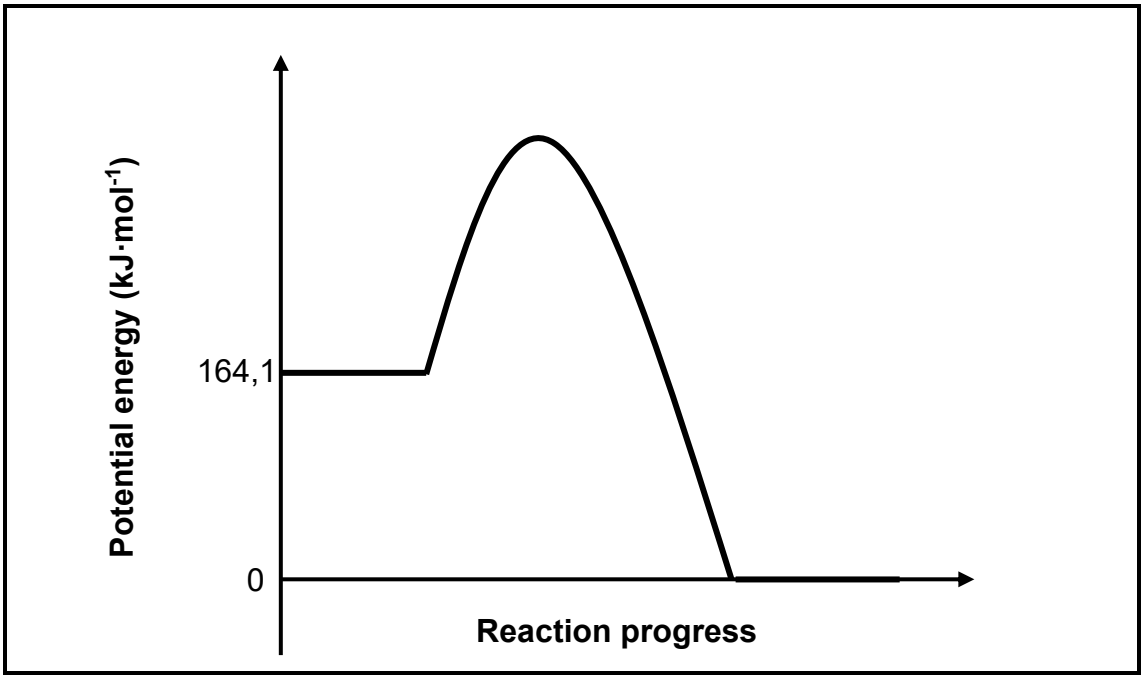
[17]

QUESTION 5 (Start on a new page.)

Consider the balanced equation that shows the decomposition of nitrogen oxide (N_2O) into nitrogen (N_2) and oxygen (O_2) molecules.

$$2\ N_2O\ (g) \rightarrow 2\ N_2\ (g) + O_2\ (g)$$

The energy profile graph is drawn for the decomposition of N_2O.



5.1 Define the term *heat of reaction.* (2)

5.2 Is the above reaction ENDOTHERMIC or EXOTHERMIC?

Give a reason for the answer. (2)

5.3 Calculate the heat of reaction. (2)

5.4 The energy that is released from the formation of N_2 and O_2 molecules are 405,30 kJ·mol^{-1}.

Calculate the activation energy for this reaction. (3)

5.5 Redraw the energy profile graph in your ANSWER BOOK.

Draw on the same set of axes the effect that a catalyst would have on the energy profile graph.

Indicate the graph of the catalyst with a dotted line. (2)

[11]

QUESTION 6 (Start on a new page.)

A certain organic compound ($C_xH_yO_z$) is composed of 54,54 g of carbon; 9,1 g of hydrogen and 36,36 g of oxygen and has a molecular mass of 88 g·mol^{-1}.

6.1 Define the term *molar mass.* (2)

6.2 Determine by calculation, the molecular formula of the organic compound ($C_xH_yO_z$) (7)

6.3 A bottle in a laboratory contains an unknown **metal** hydroxide (**M**OH). A lab technician dissolves 1,826 g of the metal hydroxide to make a 100 cm^3 solution. Upon analysis it was found that the concentration of the metal hydroxide is 0,326 mol·dm^{-3}.

6.3.1 Define the term *concentration.* (2)

6.3.2 Determine by calculation, the name of the metal hydroxide. (5)

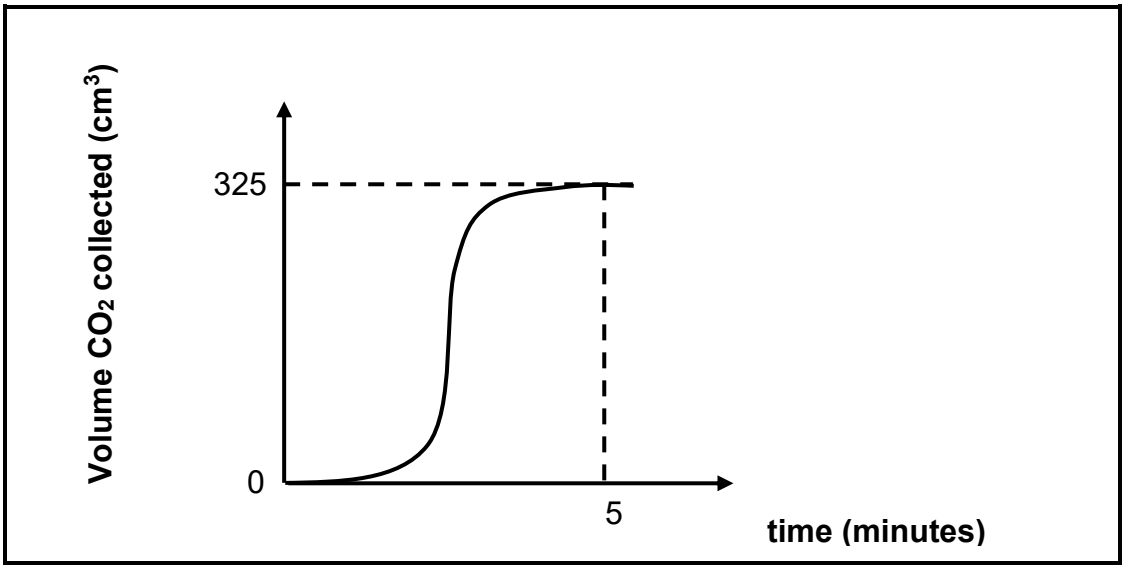
[16]

QUESTION 7 (Start on a new page.)

Learners crushed eggshells to determine the percentage of calcium carbonate that are found in a 1,5 g sample. The crushed eggshells are allowed to react with EXCESS hydrochloric acid. The balanced equation for the reaction:

$$CaCO_3(s) + 2\,HC\ell\,(aq) \rightarrow CaC\ell_2(aq) + CO_2(g) + H_2O(\ell)$$

The calcium carbonate reacted completely in 5 minutes. The graph below shows the carbon dioxide gas that was collected at STP.



7.1 Define the term *limiting reagent.* (2)

Calculate the:

7.2 Mass of calcium carbonate contained in the 1,5 g sample of eggshells (5)

7.3 Percentage purity of calcium carbonate in 1,5 g of eggshells (2)

7.4 Number of molecules of $HC\ell$ that reacted with calcium carbonate (4)

7.5 How does the carbon dioxide gas produced after 8 min compare to the carbon dioxide gas produced at 5 min?

Write down only HIGHER THAN, SMALLER THAN or EQUAL TO.

Give a reason for the answer. (2)

[15]

QUESTION 8 (Start on a new page.)

Consider the reactions below:

$$HSO_4^-(aq) + H_2O(\ell) \rightarrow H_3O^+(aq) + SO_4^{2-}(aq)$$

8.1 Define an *acid* in terms of Arrhenius theory. (2)

8.2 From the reaction above, write down the:

8.2.1 Formulae of the TWO substances that can act as ampholytes (2)

8.2.2 Conjugate base of HSO_4^- (1)

8.3 500 cm^3 of NaOH are added to 500 cm^3 of HNO_3 with a concentration of 0,25 $mol \cdot dm^{-3}$. The temperature of the reaction mixture rises during the reaction. The pH of the final solution is 2,8. The balanced equation is shown below.

$$NaOH(aq) + HNO_3(aq) \rightarrow NaNO_3(aq) + H_2O(\ell)$$

8.3.1 Describe the term *acid base indicator*. (2)

8.3.2 Write down the colour when bromothymol blue is added to HNO_3 solution. (1)

8.3.3 Is the reaction above EXOTHERMIC or ENDOTHERMIC? Give a reason for the answer. (2)

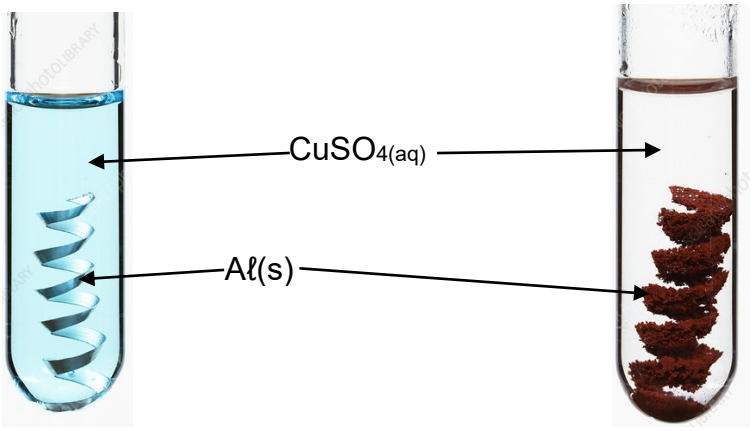
8.3.4 Calculate the concentration of H_3O^+ in the final solution. (3)

8.3.5 Calculate the initial concentration of NaOH solution. (7)

[20]

QUESTION 9 (Start on a new page.)

A clean piece of aluminium metal strip is placed in a copper sulphate ($CuSO_4$) solution. The reaction was observed again after 2 hours.



At the start After 2 hours

After 2 hours it was observed that the blue solution turned colourless and the shiny metallic aluminium turned brown.

The net ionic balanced equation for the reaction is given below:

$$2\ A\ell\ (s) + 3\ Cu^{2+}(aq) \rightarrow 3\ Cu\ (s) + 2\ A\ell^{3+}(aq)$$

9.1 Explain the term *oxidation* in terms of oxidation number. (2)

9.2 Write down the chemical symbol of a substance that is …

9.2.1 oxidised. (2)

9.2.2 the oxidising agent. (2)

9.3 Will the oxidation number of the sulphate ion INCREASE, DECREASE or REMAIN THE SAME during this reaction?

Give a reason for the answer. (2)

9.4 Acidified potassium dichromate ($K_2Cr_2O_7$) is an orange solution due to the presence of the dichromate ions ($Cr_2O_7^{2-}$).

9.4.1 Determine the oxidation number of chromium (Cr) in $Cr_2O_7^{2-}$. (2)

When iron sulphate solution ($FeSO_4$) is added to acidified potassium dichromate ($K_2Cr_2O_7$) solution, the solution changes colour from orange to green after a few seconds. During this reaction Fe^{2+} ions were oxidised to Fe^{3+} and $Cr_2O_7^{2-}$ is reduced to Cr^{3+}

9.4.2 Will the concentration of the potassium dichromate INCREASE, DECREASE or REMAINS THE SAME as the reaction proceeds?

Explain the answer by referring to the relevant half-reaction. (4)

9.4.3 Write down the balance net ionic equation for this reaction. (3)

[17]

TOTAL: 150

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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 *Standaarddruk*	p^{θ}	$1{,}013 \times 10^5$ Pa
Molar gas volume at STP *Molêre gasvolume teen STD*	V_m	22,4 $dm^3 \cdot mol^{-1}$
Standard temperature *Standaardtemperatuur*	T^{θ}	273 K
Charge on electron Lading op elektron	e	$-1{,}6 \times 10^{-19}$ C
Avogadro's constant Avogadro se konstante	N_A	$6{,}02 \times 10^{23}$ mol^{-1}

TABLE 2: FORMULAE/TABEL 2: FORMULES

$p_1V_1 = p_2V_2$	$n = \frac{m}{M}$	$K_w = [H_3O^+][OH^-] = 1x10^{-14}$ at/by 298 K
$n = \frac{N}{N_A}$ **OR/*OF***	$n = \frac{V}{V_M}$	$pH = -\log[H_3O^+]$
$c = \frac{n}{V}$ **OR/*OF*** $c = \frac{m}{MV}$	$\frac{c_aV_a}{c_bV_b} = \frac{n_a}{n_b}$	

TABLE 3: THE PERIODIC TABLE OF ELEMENTS/*TABEL 3: DIE PERIODIEKE TABEL VAN ELEMENT*

1 (I)	2 (II)	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)
2,1 H 1																	2 He 4
1,0 3 Li 7	1,5 4 Be 9											2,0 5 B 11	2,5 6 C 12	3,0 7 N 14	3,5 8 O 16	4,0 9 F 19	10 Ne 20
0,9 11 Na 23	1,2 12 Mg 24											1,5 13 Aℓ 27	1,8 14 Si 28	2,1 15 P 31	2,5 16 S 32	3,0 17 Cℓ 35,5	18 Ar 40
0,8 19 K 39	1,0 20 Ca 40	1,3 21 Sc 45	1,5 22 Ti 48	1,6 23 V 51	1,6 24 Cr 52	1,5 25 Mn 55	1,8 26 Fe 56	1,8 27 Co 59	1,8 28 Ni 59	1,9 29 Cu 63,5	1,6 30 Zn 65	1,6 31 Ga 70	1,8 32 Ge 73	2,0 33 As 75	2,4 34 Se 79	2,8 35 Br 80	36 Kr 84
0,8 37 Rb 86	1,0 38 Sr 88	1,2 39 Y 89	1,4 40 Zr 91	41 Nb 92	1,8 42 Mo 96	1,9 43 Tc	2,2 44 Ru 101	2,2 45 Rh 103	2,2 46 Pd 106	1,9 47 Ag 108	1,7 48 Cd 112	1,7 49 In 115	1,8 50 Sn 119	1,9 51 Sb 122	2,1 52 Te 128	2,5 53 I 127	54 Xe 131
0,7 55 Cs 133	0,9 56 Ba 137	57 La 139	1,6 72 Hf 179	73 Ta 181	74 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	1,8 81 Tℓ 204	1,8 82 Pb 207	1,9 83 Bi 209	2,0 84 Po	2,5 85 At	86 Rn
0,7 87 Fr	0,9 88 Ra 226	89 Ac															

58 Ce 140	59 Pr 141	60 Nd 144	61 Pm	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 163	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175
90 Th 232	91 Pa	92 U 238	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

KEY/ *SLEUTEL*

Atoomgetal

Atomic number

29

Elektronegatiwiteit → 1,9 Cu ← *Simbool*

Electronegativity → 1,9 Cu ← Symbol

Approximate relative atomic mass/
Benaderde relatiewe atoommassa

TABLE 4A: STANDARD REDUCTION POTENTIALS
TABEL 4A: STANDAARD REDUKSIEPOTENSIALE

Increasing oxidising ability/*Toenemende oksiderende vermoë* ↑

Half-reactions/*Halfreaksies*	E^θ (V)
$F_2(g) + 2e^- \rightleftharpoons 2F^-$	+ 2,87
$Co^{3+} + e^- \rightleftharpoons Co^{2+}$	+ 1,81
$H_2O_2 + 2H^+ + 2e^- \rightleftharpoons 2H_2O$	+ 1,77
$MnO_4^- + 8H^+ + 5e^- \rightleftharpoons Mn^{2+} + 4H_2O$	+ 1,51
$C\ell_2(g) + 2e^- \rightleftharpoons 2C\ell^-$	+ 1,36
$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightleftharpoons 2Cr^{3+} + 7H_2O$	+ 1,33
$O_2(g) + 4H^+ + 4e^- \rightleftharpoons 2H_2O$	+ 1,23
$MnO_2 + 4H^+ + 2e^- \rightleftharpoons Mn^{2+} + 2H_2O$	+ 1,23
$Pt^{2+} + 2e^- \rightleftharpoons Pt$	+ 1,20
$Br_2(\ell) + 2e^- \rightleftharpoons 2Br^-$	+ 1,07
$NO_3^- + 4H^+ + 3e^- \rightleftharpoons NO(g) + 2H_2O$	+ 0,96
$Hg^{2+} + 2e^- \rightleftharpoons Hg(\ell)$	+ 0,85
$Ag^+ + e^- \rightleftharpoons Ag$	+ 0,80
$NO_3^- + 2H^+ + e^- \rightleftharpoons NO_2(g) + H_2O$	+ 0,80
$Fe^{3+} + e^- \rightleftharpoons Fe^{2+}$	+ 0,77
$O_2(g) + 2H^+ + 2e^- \rightleftharpoons H_2O_2$	+ 0,68
$I_2 + 2e^- \rightleftharpoons 2I^-$	+ 0,54
$Cu^+ + e^- \rightleftharpoons Cu$	+ 0,52
$SO_2 + 4H^+ + 4e^- \rightleftharpoons S + 2H_2O$	+ 0,45
$2H_2O + O_2 + 4e^- \rightleftharpoons 4OH^-$	+ 0,40
$Cu^{2+} + 2e^- \rightleftharpoons Cu$	+ 0,34
$SO_4^{2-} + 4H^+ + 2e^- \rightleftharpoons SO_2(g) + 2H_2O$	+ 0,17
$Cu^{2+} + e^- \rightleftharpoons Cu^+$	+ 0,16
$Sn^{4+} + 2e^- \rightleftharpoons Sn^{2+}$	+ 0,15
$S + 2H^+ + 2e^- \rightleftharpoons H_2S(g)$	+ 0,14
$2H^+ + 2e^- \rightleftharpoons H_2(g)$	**0,00**
$Fe^{3+} + 3e^- \rightleftharpoons Fe$	– 0,06
$Pb^{2+} + 2e^- \rightleftharpoons Pb$	– 0,13
$Sn^{2+} + 2e^- \rightleftharpoons Sn$	– 0,14
$Ni^{2+} + 2e^- \rightleftharpoons Ni$	– 0,27
$Co^{2+} + 2e^- \rightleftharpoons Co$	– 0,28
$Cd^{2+} + 2e^- \rightleftharpoons Cd$	– 0,40
$Cr^{3+} + e^- \rightleftharpoons Cr^{2+}$	– 0,41
$Fe^{2+} + 2e^- \rightleftharpoons Fe$	– 0,44
$Cr^{3+} + 3e^- \rightleftharpoons Cr$	– 0,74
$Zn^{2+} + 2e^- \rightleftharpoons Zn$	– 0,76
$2H_2O + 2e^- \rightleftharpoons H_2(g) + 2OH^-$	– 0,83
$Cr^{2+} + 2e^- \rightleftharpoons Cr$	– 0,91
$Mn^{2+} + 2e^- \rightleftharpoons Mn$	– 1,18
$A\ell^{3+} + 3e^- \rightleftharpoons A\ell$	– 1,66
$Mg^{2+} + 2e^- \rightleftharpoons Mg$	– 2,36
$Na^+ + e^- \rightleftharpoons Na$	– 2,71
$Ca^{2+} + 2e^- \rightleftharpoons Ca$	– 2,87
$Sr^{2+} + 2e^- \rightleftharpoons Sr$	– 2,89
$Ba^{2+} + 2e^- \rightleftharpoons Ba$	– 2,90
$Cs^+ + e^- \rightleftharpoons Cs$	– 2,92
$K^+ + e^- \rightleftharpoons K$	– 2,93
$Li^+ + e^- \rightleftharpoons Li$	– 3,05

Increasing reducing ability/*Toenemende reduserende vermoë* ↓

TABLE 4B: STANDARD REDUCTION POTENTIALS
TABEL 4B: STANDAARD REDUKSIEPOTENSIALE

Increasing oxidising ability/*Toenemende oksiderende vermoë* ↓

Increasing reducing ability/*Toenemende reduserende vermoë* ↑

Half-reactions/*Halfreaksies*			E^{θ} (V)
$Li^+ + e^-$	⇌	Li	− 3,05
$K^+ + e^-$	⇌	K	− 2,93
$Cs^+ + e^-$	⇌	Cs	− 2,92
$Ba^{2+} + 2e^-$	⇌	Ba	− 2,90
$Sr^{2+} + 2e^-$	⇌	Sr	− 2,89
$Ca^{2+} + 2e^-$	⇌	Ca	− 2,87
$Na^+ + e^-$	⇌	Na	− 2,71
$Mg^{2+} + 2e^-$	⇌	Mg	− 2,36
$A\ell^{3+} + 3e^-$	⇌	$A\ell$	− 1,66
$Mn^{2+} + 2e^-$	⇌	Mn	− 1,18
$Cr^{2+} + 2e^-$	⇌	Cr	− 0,91
$2H_2O + 2e^-$	⇌	$H_2(g) + 2OH^-$	− 0,83
$Zn^{2+} + 2e^-$	⇌	Zn	− 0,76
$Cr^{3+} + 3e^-$	⇌	Cr	− 0,74
$Fe^{2+} + 2e^-$	⇌	Fe	− 0,44
$Cr^{3+} + e^-$	⇌	Cr^{2+}	− 0,41
$Cd^{2+} + 2e^-$	⇌	Cd	− 0,40
$Co^{2+} + 2e^-$	⇌	Co	− 0,28
$Ni^{2+} + 2e^-$	⇌	Ni	− 0,27
$Sn^{2+} + 2e^-$	⇌	Sn	− 0,14
$Pb^{2+} + 2e^-$	⇌	Pb	− 0,13
$Fe^{3+} + 3e^-$	⇌	Fe	− 0,06
$2H^+ + 2e^-$	**⇌**	**$H_2(g)$**	**0,00**
$S + 2H^+ + 2e^-$	⇌	$H_2S(g)$	+ 0,14
$Sn^{4+} + 2e^-$	⇌	Sn^{2+}	+ 0,15
$Cu^{2+} + e^-$	⇌	Cu^+	+ 0,16
$SO_4^{2-} + 4H^+ + 2e^-$	⇌	$SO_2(g) + 2H_2O$	+ 0,17
$Cu^{2+} + 2e^-$	⇌	Cu	+ 0,34
$2H_2O + O_2 + 4e^-$	⇌	$4OH^-$	+ 0,40
$SO_2 + 4H^+ + 4e^-$	⇌	$S + 2H_2O$	+ 0,45
$Cu^+ + e^-$	⇌	Cu	+ 0,52
$I_2 + 2e^-$	⇌	$2I^-$	+ 0,54
$O_2(g) + 2H^+ + 2e^-$	⇌	H_2O_2	+ 0,68
$Fe^{3+} + e^-$	⇌	Fe^{2+}	+ 0,77
$NO_3^- + 2H^+ + e^-$	⇌	$NO_2(g) + H_2O$	+ 0,80
$Ag^+ + e^-$	⇌	Ag	+ 0,80
$Hg^{2+} + 2e^-$	⇌	$Hg(\ell)$	+ 0,85
$NO_3^- + 4H^+ + 3e^-$	⇌	$NO(g) + 2H_2O$	+ 0,96
$Br_2(\ell) + 2e^-$	⇌	$2Br^-$	+ 1,07
$Pt^{2+} + 2e^-$	⇌	Pt	+ 1,20
$MnO_2 + 4H^+ + 2e^-$	⇌	$Mn^{2+} + 2H_2O$	+ 1,23
$O_2(g) + 4H^+ + 4e^-$	⇌	$2H_2O$	+ 1,23
$Cr_2O_7^{2-} + 14H^+ + 6e^-$	⇌	$2Cr^{3+} + 7H_2O$	+ 1,33
$C\ell_2(g) + 2e^-$	⇌	$2C\ell^-$	+ 1,36
$MnO_4^- + 8H^+ + 5e^-$	⇌	$Mn^{2+} + 4H_2O$	+ 1,51
$H_2O_2 + 2H^+ + 2e^-$	⇌	$2H_2O$	+ 1,77
$Co^{3+} + e^-$	⇌	Co^{2+}	+ 1,81
$F_2(g) + 2e^-$	⇌	$2F^-$	+ 2,87

