



# higher education & training

Department:  
Higher Education and Training  
**REPUBLIC OF SOUTH AFRICA**

## **NATIONAL CERTIFICATE (VOCATIONAL)**

### **PHYSICAL SCIENCE**

(Second paper)

**NQF LEVEL 4**

(10021004)

**4 December 2020 (X-paper)**

**09:00–12:00**

**A non-programmable calculator may be used.**

**This question paper consists of 16 pages, 1 table of standard reduction potentials  
and 1 periodic table.**

313Q2N2004

<p><b>TIME: 3 HOURS</b> <b>MARKS: 150</b></p>
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**INSTRUCTIONS AND INFORMATION**

1. Answer all the questions.
2. Read all the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Start each question on a new page.
5. Appropriate mathematical instruments should be used.
6. Show all formulae and substitutions in all calculations.
7. Round off all final numerical answers to a minimum of TWO decimal places.
8. Write your EXAMINATION NUMBER and CENTRE NUMBER in the appropriate spaces on the ANSWER BOOK
9. Give brief motivations, discussions, etc. where required.
10. Write neatly and legibly.

**SECTION A****QUESTION 1**

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

- 1.1 Radiation that can be stopped by a piece of cardboard.
- 1.2 The element in fertiliser that promotes the flowering of plants.
- 1.3 Weak intermolecular forces present in all organic molecules.
- 1.4 Process in which large organic molecules are broken down into smaller units.
- 1.5 High-speed electrons ejected from the nucleus during radioactivity.

CE

(5 × 1)

**[5]****QUESTION 2**

Choose an item from COLUMN B that matches a description in COLUMN A. Write only the letter (A–L) next to the question number (2.1–2.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
2.1	SI unit second for nuclear transformations per second	A	end point
2.2	Responsible for the low vapour pressure of carboxylic acids	B	concentration
2.3	Stage in a titration when an indicator changes colour	C	mol·dm <sup>-3</sup>
2.4	Solution with equal concentrations of hydroxide and hydronium ions	D	becquerel
2.5	Indicates the acidity or alkalinity of a solution	E	melting point
		F	covalent bonding
		G	neutral
		H	hydrogen bonding
		I	standard solution
		J	sodium hydroxide
		K	pH
		L	curie

CE

(5 × 1)

**[5]**

**QUESTION 3**

Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (3.1–3.5) in the ANSWER BOOK.

- 3.1 The burning of coal increases the carbon dioxide content of the atmosphere.
- 3.2 The shelf life of fresh fruit is increased by exposure to radiation.
- 3.3 Moderators slow down fast-moving protons in a nuclear reactor.
- 3.4 The polymerisation of ethene produces polyvinyl chloride.
- 3.5 Protons are transferred in a redox reaction.



(5 × 2) [10]

**QUESTION 4**

Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (4.1–4.5) in the ANSWER BOOK.

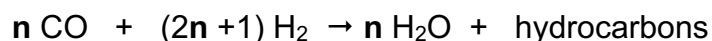
- 4.1 The table shows the count rate of a radioactive source taken at regular time intervals. The count rate has been corrected for background radiation.

Time (minutes)	10	20	30	40	50
Count rate (counts per minute)	800	630	500	400	315



What is the half-life of an isotope, in minutes?

- A 40  
B 30  
C 20  
D 10
- 4.2 A mixture of carbon monoxide and hydrogen can be converted into water and a mixture of hydrocarbons.

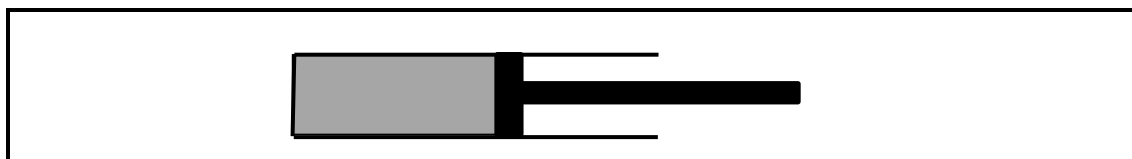
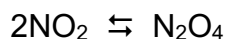


What is the general formula for the hydrocarbons produced?

- A  $\text{C}_n\text{H}_{2n}$   
B  $\text{C}_n\text{H}_{2n-2}$   
C  $\text{C}_n\text{H}_{2n+1}$   
D  $\text{C}_n\text{H}_{2n+2}$



- 4.3 A pale brown mixture of  $\text{N}_2\text{O}_4$  and  $\text{NO}_2$  is allowed to reach chemical equilibrium in a sealed gas syringe according to the following equation.



When the plunger is pushed further into the syringe, the pressure increases, and the mixture becomes paler in colour.

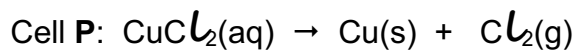
When the syringe is placed in hot water, the mixture becomes darker in colour.

Which ONE of the following statements is correct?



- A  $\text{NO}_2$  is brown and the forward reaction is exothermic.
- B  $\text{NO}_2$  is brown and the forward reaction is endothermic.
- C  $\text{NO}_2$  is colourless and the forward reaction is exothermic.
- D  $\text{NO}_2$  is colourless and the forward reaction is endothermic.

- 4.4 The reactions below take place in two different electrochemical cells, **P** and **Q**.

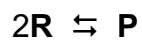


Which ONE of the following correctly represents the product that is formed at the CATHODE of each cell?

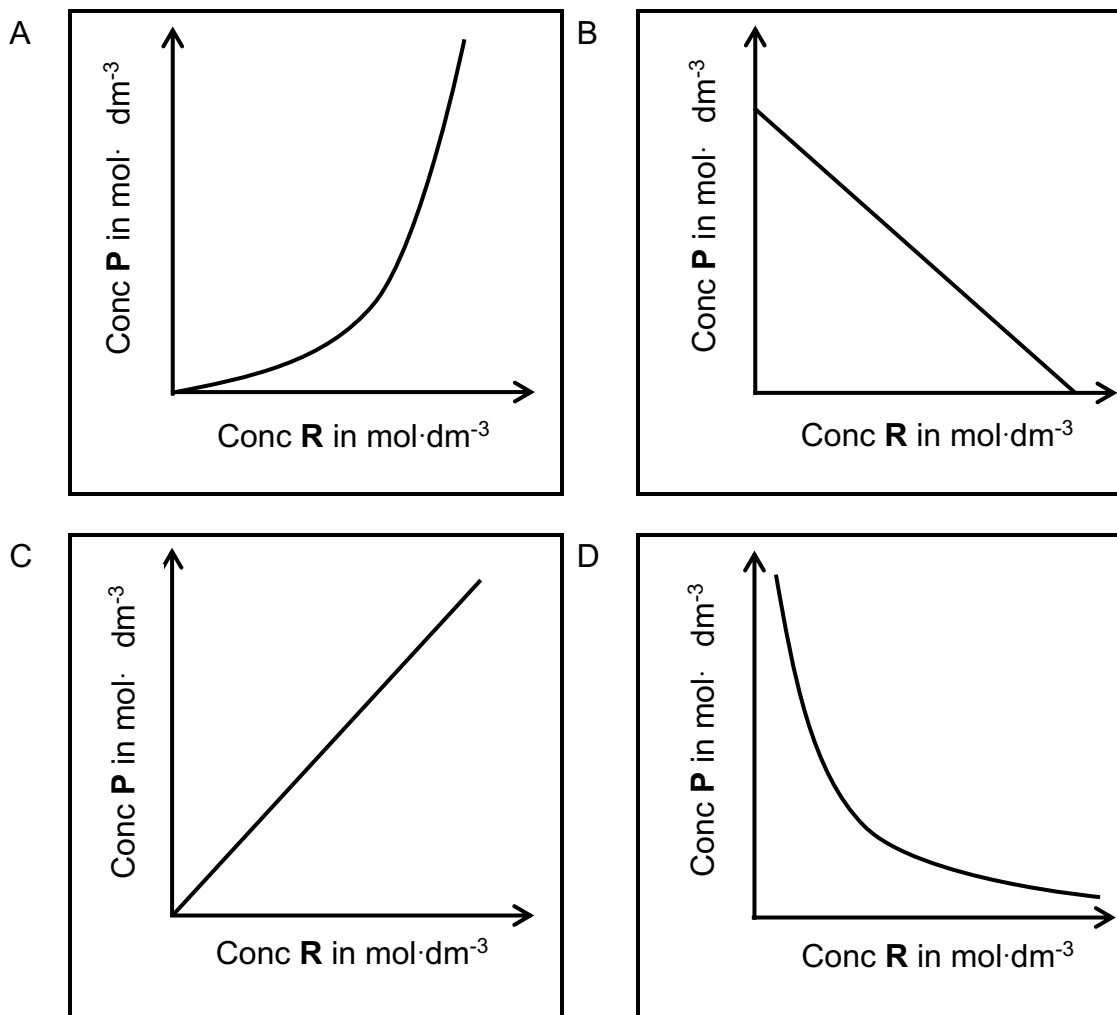
	Cell P	Cell Q
A	$\text{Cl}_2(\text{g})$	$\text{ZnSO}_4(\text{aq})$
B	$\text{Cl}_2(\text{g})$	$\text{Cu}(\text{s})$
C	$\text{Cu}(\text{s})$	$\text{Cu}(\text{s})$
D	$\text{Cu}(\text{s})$	$\text{ZnSO}_4(\text{aq})$



- 4.5 The chemical equation below represents a closed system in equilibrium at 25 °C.



Which ONE of the graphs CORRECTLY represents the relationship between the concentrations of **P** and **R** at 25 °C



(5 × 3)

[15]



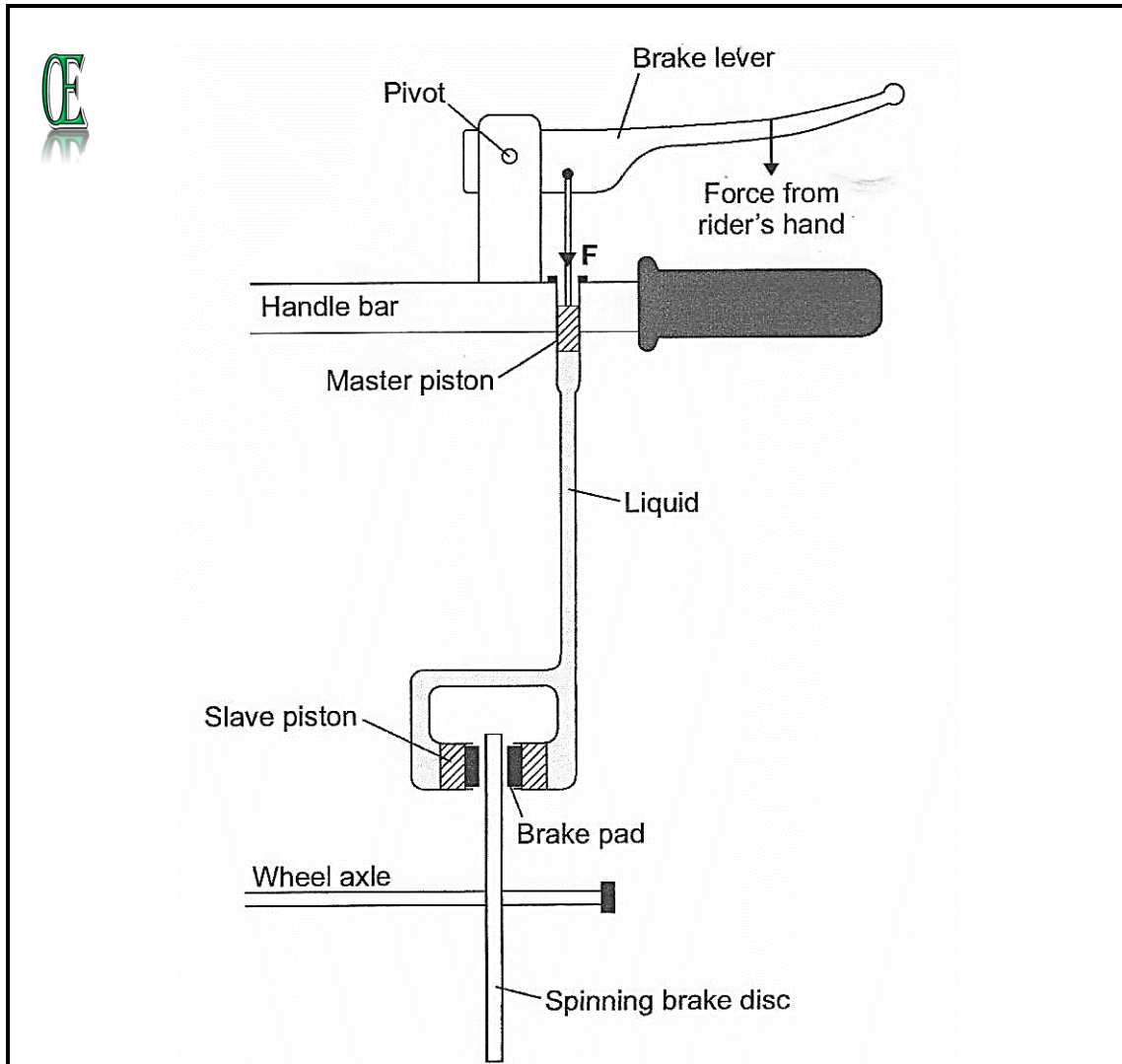
TOTAL SECTION A:

35

## SECTION B

## QUESTION 5

- 5.1 Some mountain bikes use liquid-filled pipes to transmit the force from the rider's hand on the brake lever to the brake pads. These brakes are illustrated below.



5.1.1 Name the principle on which this braking system operates. (1)

5.1.2 Complete the following sentences by writing only the correct option of those given in brackets next to the question number ((a)–(b)) in the ANSWER BOOK.

- (a) Liquids can be used to transmit the forces in a brake system because liquids (are incompressible; can flow; take the shape of the container).
- (b) The pressure in the liquid is transmitted (sideways; downwards; in all directions). (2)

5.1.3 When the rider's hand pulls the brake lever, the force  $F$  applied to the liquid by the master piston is 80 N. The cross-sectional area of this piston is  $50 \text{ mm}^2$ .

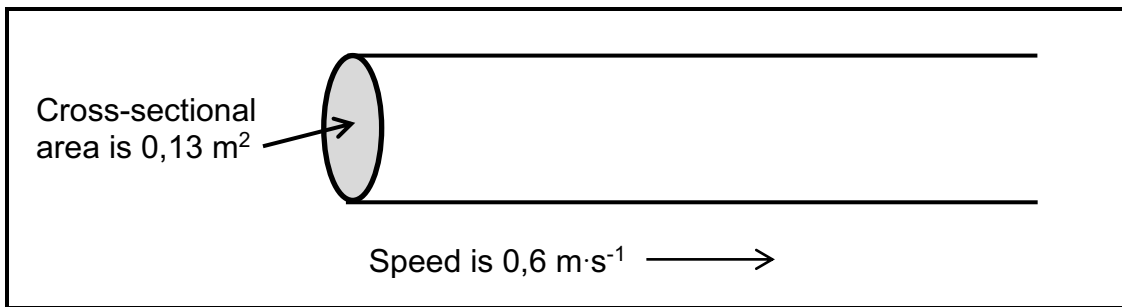


Calculate the following:

- (a) The pressure exerted on the liquid by the master piston
- (b) The force exerted by the liquid on the slave piston which has an area of  $2 \times 10^{-4} \text{ m}^2$

(2 × 3) (6)

5.2 Water flows at a speed of  $0,6 \text{ m}\cdot\text{s}^{-1}$  in a horizontal pipe which has a cross-sectional area of  $0,13 \text{ m}^2$ .



What is the flow rate of the liquid in the pipe?



(1)  
[10]



**QUESTION 6**

The letters A to F in the table below represent six organic compounds.

<b>A.</b>	$\begin{array}{c} \text{H} \quad \text{H} \\   \quad   \\ \text{H}-\text{C}-\text{C}-\text{C}\equiv\text{C}-\text{H} \\   \quad   \\ \text{H} \quad \text{H} \end{array}$	<b>D.</b>	$\begin{array}{c} \text{H} \quad \text{O} \\   \quad    \\ \text{H}-\text{C}-\text{C}-\text{O}-\text{H} \\   \\ \text{H} \end{array}$
<b>B.</b>	Ethene	<b>E.</b>	Propane
<b>C.</b>	$\begin{array}{c} \text{H} \\   \\ \text{H}-\text{C}-\text{O}-\text{H} \\   \quad   \quad   \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\   \quad   \quad   \quad   \\ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \end{array}$	<b>F.</b>	$\begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\   \quad   \quad   \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\   \quad   \quad   \\ \text{H} \quad \text{O} \quad \text{H} \\   \\ \text{H} \end{array}$

6.1 Natural gases and petroleum are sources of hydrocarbons.

6.1.1 What are *hydrocarbons*?

**CE**

(2)

6.1.2 Write a balanced equation for the combustion of compound E in excess oxygen.

(3)

6.2 Isomers are compounds with the same molecular formula but different structures.

6.2.1 Draw the structural formula for a tertiary alcohol of compound C.

6.2.2 What is the IUPAC name for the answer to QUESTION 6.2.1?

(2 × 2)

(4)

6.3 A homologous series is defined by a general formula and a functional group.

6.3.1 Write the general formula for the homologous series to which compound B belongs.

(2)

6.3.2 Name the functional group of compound F.

(2)

6.3.3 What is the IUPAC name for:

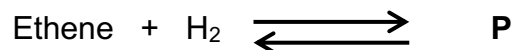
(a) Compound A

**CE**

(b) Compound D

(4)

6.4 Compound B (ethene) reacts with hydrogen gas under certain reaction conditions.



6.4.1 Is the organic reactant SATURATED or UNSATURATED? (1)

6.4.2 Give ONE reason for the answer to QUESTION 6.4.1 (2)

6.4.3 State TWO conditions required for this reaction. (2)

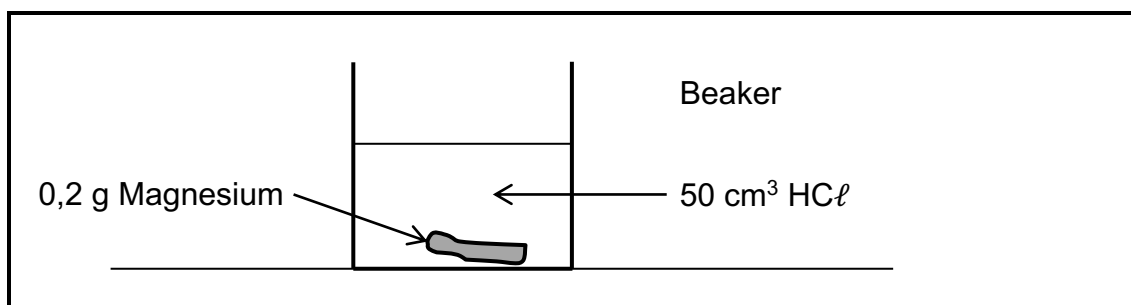
6.4.4 Name the product P. (2)

[24]



### QUESTION 7

7.1 A student investigated the rate of the reaction between magnesium and excess hydrochloric acid using the apparatus illustrated below.



She followed the following procedure:

- Poured 50 cm<sup>3</sup> of HCl into a clean, dry beaker.
- Added 0,2 g Mg into the beaker and simultaneously started a stopwatch.
- Stopped the watch when no more gas bubbles were produced.
- Recorded the reaction time.
- Repeated the experiment using different reaction conditions.



The reaction that occurred is:  $\text{Mg} + 2 \text{HCl} \longrightarrow \text{MgCl}_2 + \text{H}_2$

The following results were tabulated:

EXPERIMENT	TEMPERATURE OF ACID (°C)	CONCENTRATION OF ACID	MAGNESIUM	REACTION TIME (s)
A	25	diluted	ribbon	240
B	25	concentrated	ribbon	120
C	30	diluted	ribbon	100
D	25	diluted	powder	50

7.1.1 State TWO conditions necessary for an effective collision according to the kinetic collision theory. (2)

7.1.2 Calculate the average reaction rate for experiment A in  $\text{mol}\cdot\text{s}^{-1}$ . (4)

7.1.3 What is the independent variable in:

(a) Experiments A and B

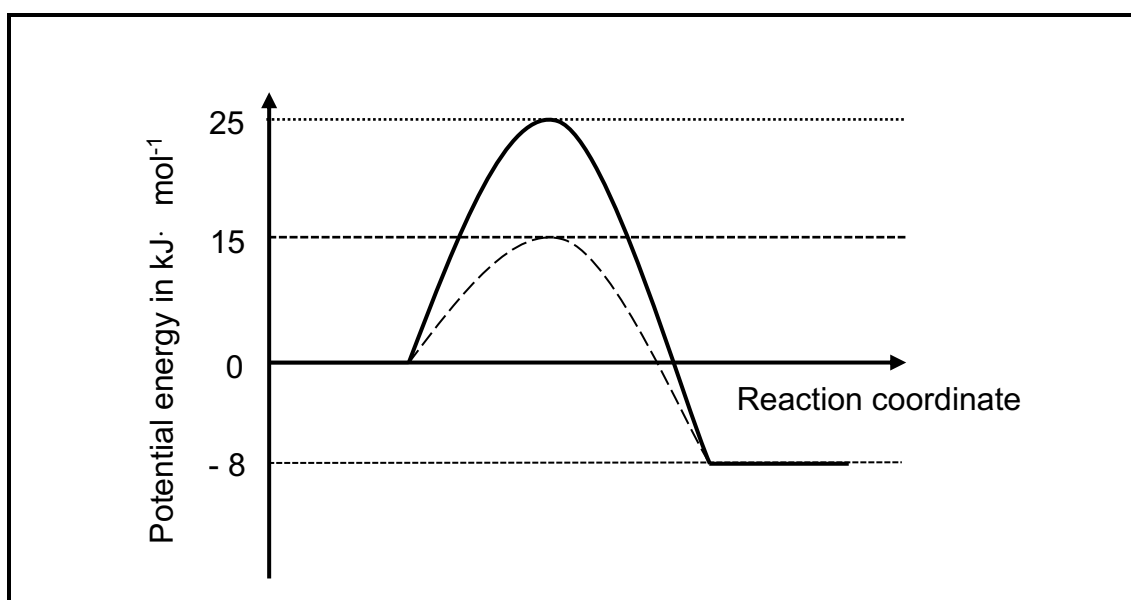
CE

(b) Experiments A and D

(2 × 1) (2)

7.1.4 Write a suitable conclusion for experiments A and C. (2)

7.2 The following graph illustrates the potential energy changes during a catalysed (-----) and an uncatalysed (————) reaction.



7.2.1 Is this reaction EXOTHERMIC or ENDOTHERMIC? (1)

7.2.2 Give ONE reason for the answer to QUESTION 7.2.1. (1)

7.2.3 From the graph, calculate the following:

(a) The change in the potential energy of the activated complex by the addition of a catalyst

(b) The activation energy for the reverse catalysed reaction

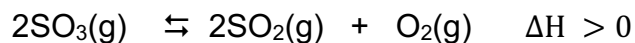
CE

(2 × 1) (2)

[14]

**QUESTION 8**

At high temperatures and in the presence of a catalyst, sulphur trioxide decomposes according to the following equation:



In an experiment, 0,8 moles of sulphur trioxide were placed in a container with a volume of 2 dm<sup>3</sup> and allowed to reach chemical equilibrium at temperature T<sub>1</sub>.

At temperature T<sub>1</sub> the equilibrium concentration of oxygen was 0,07 mol·dm<sup>-3</sup>

8.1 What is the initial concentration of sulphur trioxide? (3)

8.2 Determine the equilibrium concentration of the following:



8.2.1 SO<sub>2</sub>(g)

8.2.2 SO<sub>3</sub>(g)

(2 × 1) (2)

8.3 Calculate the equilibrium constant (K<sub>c</sub>) for this equilibrium at temperature T<sub>1</sub>. (3)

8.4 If the temperature of this equilibrium system is increased, will the value of K<sub>c</sub> INCREASE, DECREASE or REMAIN CONSTANT? (1)

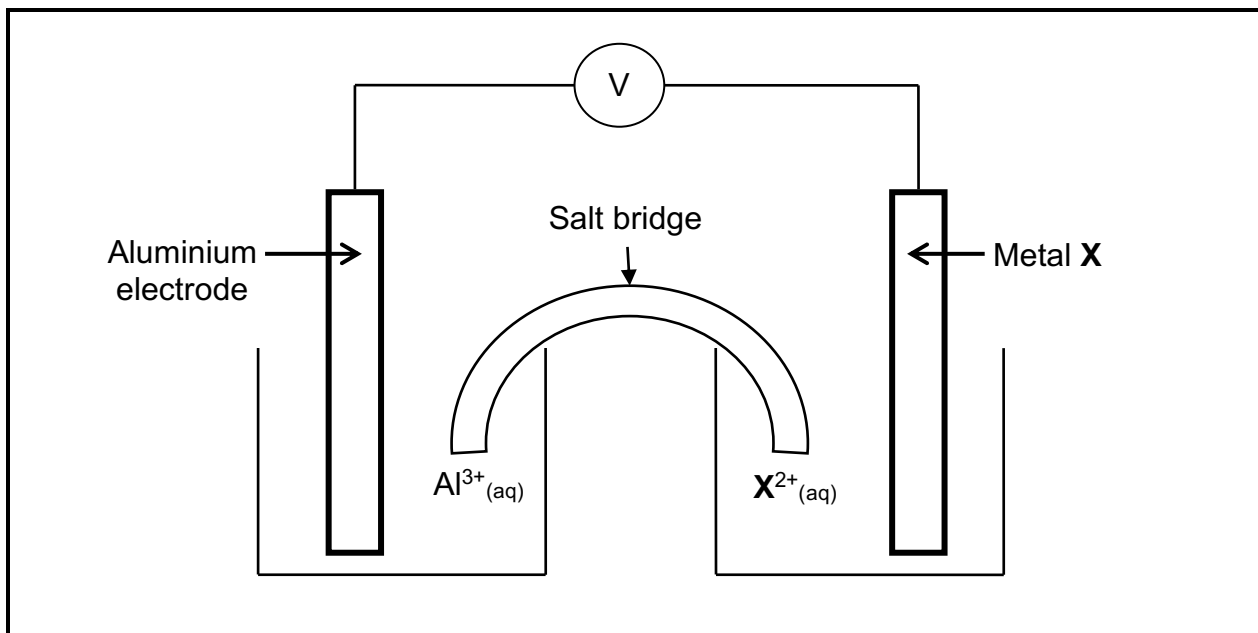
8.5 Explain the answer to QUESTION 8.4.



(3)  
**[12]**

**QUESTION 9**

A voltaic cell is constructed by connecting an aluminium half-cell to another half-cell constructed from metal X as shown in the sketch below.



In the external circuit, electrons flow from the aluminium electrode to metal X. Under standard conditions, the initial voltmeter reading is 1,52 V.

CE

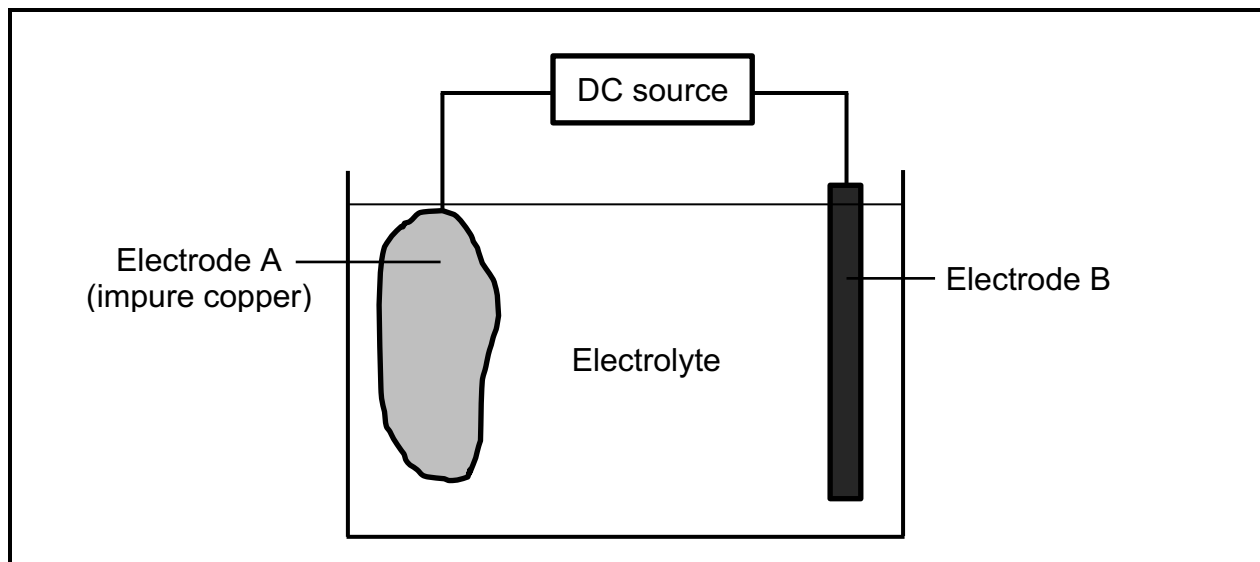
- 9.1 Represent this cell in standard notation. (3)
- 9.2 If potassium nitrate was used to make the salt bridge, write down the formula of the ion that migrates into the aluminium half-cell when the cell is in operation. (2)
- 9.3 Which metal forms the anode, ALUMINIUM or METAL X? (1)
- 9.4 State TWO standard conditions under which the maximum voltmeter reading is 1,52 V. (2)
- 9.5 Identify metal X by using a suitable calculation. Show all workings clearly. (4)
- 9.6 Will the initial cell potential INCREASE, DECREASE or REMAIN THE SAME if each of the following changes are made to this cell?
- 9.6.1 The concentration of  $\text{Al}^{3+}_{(\text{aq})}$  is increased. CE
- 9.6.2 The size of the Metal X electrode is increased. (2)

(2 × 1)

[14]

**QUESTION 10**

The diagram below represents an electrochemical cell used for the purification of copper.



- 10.1 What energy conversion occurs in this cell? **CE** (2)
- 10.2 Which electrode, A or B, forms the anode? **CE** (1)
- 10.3 Write down the half-reaction that takes place at electrode B. (2)
- 10.4 Due to small amounts of nickel impurities in the impure copper, the electrolyte becomes contaminated with  $\text{Ni}^{2+}$  ions.

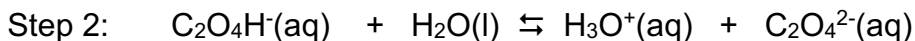
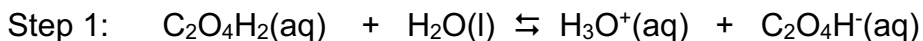
Refer to the attached Table of Standard Reduction Potentials to explain why the  $\text{Ni}^{2+}$  ions will not influence the purity of the copper obtained during this process.

**CE**

(4)  
[9]

**QUESTION 11**

11.1 Oxalic acid is a weak, diprotic acid. It ionises in two steps as follows:



11.1.1 Write down the Arrhenius definition of a base.  (2)

11.1.2 Write down the *formula* of the conjugate base of  $\text{H}_3\text{O}^+(\text{aq})$ .  (1)


11.1.3 Write down the *formula* of the substance that acts as an ampholyte in the ionisation of oxalic acid. (2)

11.2 A 500 cm<sup>3</sup> solution was prepared by mixing 7,84 g of a sodium carbonate hydrate with formula  $\text{Na}_2\text{CO}_3 \cdot n\text{H}_2\text{O}$  in sufficient water.

In a titration, 10 cm<sup>3</sup> of the sodium carbonate solution was used to exactly neutralise 16 cm<sup>3</sup> of a 0,1 mol·dm<sup>3</sup> HCl solution.



11.2.1 Calculate the concentration of the sodium carbonate solution used in the titration. (4)

11.2.2 Determine the mass of water in 7,84 g of the sodium carbonate hydrate.  (5)

11.2.3 Calculate the value of 'n'.  (4)

**[18]**

**QUESTION 12**

12.1 There are many isotopes of the element molybdenum (Mo).

What do the nuclei of the different isotopes of molybdenum have in common? (2)

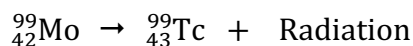
12.2 The isotope molybdenum-99 is produced inside a nuclear power stations from the nuclear fission of uranium-235.



12.2.1 What is *nuclear fission*? (2)

12.2.2 Inside which part of a nuclear power station would molybdenum-99 be produced? (1)

12.3 When the nucleus of a molybdenum-99 atom decays, it emits radiation and changes into a nucleus of technetium-99.



12.3.1 What type of radiation is emitted by molybdenum-99? (1)

12.3.2 Give a reason for the answer to QUESTION 12.3.1. (2)

12.4 Technetium-99 has a half-life of 6 hours and emits gamma radiation.



In spite of some risk to the patient's health, doctors inject it into a patient's body and use it as a medical tracer for diagnostic purposes.

12.4.1 What is meant by *half-life*?

12.4.2 If a patient is injected with 4 g of technetium-99, calculate the quantity that will remain in the body at the end of 24 hours?

12.4.3 Explain how the risk to the patient is reduced when injected with radioactive substances used as tracers.



(3 × 2)

(6)  
[14]

**TOTAL SECTION B: 115**  
**GRAND TOTAL: 150**



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

Half-reactions/Halfreaksies	$E^{\theta}$ (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
$Cl_2(g) + 2e^- \rightleftharpoons 2Cl^-$	+ 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
$Br_2(l) + 2e^- \rightleftharpoons 2Br^-$	+ 1,07
$NO_3^- + 4H^+ + 3e^- \rightleftharpoons NO(g) + 2H_2O$	+ 0,96
$Hg^{2+} + 2e^- \rightleftharpoons Hg(l)$	+ 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
<b><math>2H^+ + 2e^- \rightleftharpoons H_2(g)</math></b>	<b>0,00</b>
$Fe^{3+} + 3e^- \rightleftharpoons Fe$	- 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
$Al^{3+} + 3e^- \rightleftharpoons Al$	- 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 oxidising ability/Toenemende oksiderende vermoë

Increasing reducing ability/Toenemende reduserende vermoë

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

Half-reactions/ <i>Halfreaksies</i>	$E^\theta$ (V)
$\text{Li}^+ + e^- \rightleftharpoons \text{Li}$	-3,05
$\text{K}^+ + e^- \rightleftharpoons \text{K}$	-2,93
$\text{Cs}^+ + e^- \rightleftharpoons \text{Cs}$	-2,92
$\text{Ba}^{2+} + 2e^- \rightleftharpoons \text{Ba}$	-2,90
$\text{Sr}^{2+} + 2e^- \rightleftharpoons \text{Sr}$	-2,89
$\text{Ca}^{2+} + 2e^- \rightleftharpoons \text{Ca}$	-2,87
$\text{Na}^+ + e^- \rightleftharpoons \text{Na}$	-2,71
$\text{Mg}^{2+} + 2e^- \rightleftharpoons \text{Mg}$	-2,36
$\text{Al}^{3+} + 3e^- \rightleftharpoons \text{Al}$	-1,66
$\text{Mn}^{2+} + 2e^- \rightleftharpoons \text{Mn}$	-1,18
$\text{Cr}^{2+} + 2e^- \rightleftharpoons \text{Cr}$	-0,91
$2\text{H}_2\text{O} + 2e^- \rightleftharpoons \text{H}_2(\text{g}) + 2\text{OH}^-$	-0,83
$\text{Zn}^{2+} + 2e^- \rightleftharpoons \text{Zn}$	-0,76
$\text{Cr}^{3+} + 3e^- \rightleftharpoons \text{Cr}$	-0,74
$\text{Fe}^{2+} + 2e^- \rightleftharpoons \text{Fe}$	-0,44
$\text{Cr}^{3+} + e^- \rightleftharpoons \text{Cr}^{2+}$	-0,41
$\text{Cd}^{2+} + 2e^- \rightleftharpoons \text{Cd}$	-0,40
$\text{Co}^{2+} + 2e^- \rightleftharpoons \text{Co}$	-0,28
$\text{Ni}^{2+} + 2e^- \rightleftharpoons \text{Ni}$	-0,27
$\text{Sn}^{2+} + 2e^- \rightleftharpoons \text{Sn}$	-0,14
$\text{Pb}^{2+} + 2e^- \rightleftharpoons \text{Pb}$	-0,13
$\text{Fe}^{3+} + 3e^- \rightleftharpoons \text{Fe}$	-0,06
<b><math>2\text{H}^+ + 2e^- \rightleftharpoons \text{H}_2(\text{g})</math></b>	<b>0,00</b>
$\text{S} + 2\text{H}^+ + 2e^- \rightleftharpoons \text{H}_2\text{S}(\text{g})$	+0,14
$\text{Sn}^{4+} + 2e^- \rightleftharpoons \text{Sn}^{2+}$	+0,15
$\text{Cu}^{2+} + e^- \rightleftharpoons \text{Cu}^+$	+0,16
$\text{SO}_4^{2-} + 4\text{H}^+ + 2e^- \rightleftharpoons \text{SO}_2(\text{g}) + 2\text{H}_2\text{O}$	+0,17
$\text{Cu}^{2+} + 2e^- \rightleftharpoons \text{Cu}$	+0,34
$2\text{H}_2\text{O} + \text{O}_2 + 4e^- \rightleftharpoons 4\text{OH}^-$	+0,40
$\text{SO}_2 + 4\text{H}^+ + 4e^- \rightleftharpoons \text{S} + 2\text{H}_2\text{O}$	+0,45
$\text{Cu}^+ + e^- \rightleftharpoons \text{Cu}$	+0,52
$\text{I}_2 + 2e^- \rightleftharpoons 2\text{I}^-$	+0,54
$\text{O}_2(\text{g}) + 2\text{H}^+ + 2e^- \rightleftharpoons \text{H}_2\text{O}_2$	+0,68
$\text{Fe}^{3+} + e^- \rightleftharpoons \text{Fe}^{2+}$	+0,77
$\text{NO}_3^- + 2\text{H}^+ + e^- \rightleftharpoons \text{NO}_2(\text{g}) + \text{H}_2\text{O}$	+0,80
$\text{Ag}^+ + e^- \rightleftharpoons \text{Ag}$	+0,80
$\text{Hg}^{2+} + 2e^- \rightleftharpoons \text{Hg}(\ell)$	+0,85
$\text{NO}_3^- + 4\text{H}^+ + 3e^- \rightleftharpoons \text{NO}(\text{g}) + 2\text{H}_2\text{O}$	+0,96
$\text{Br}_2(\ell) + 2e^- \rightleftharpoons 2\text{Br}^-$	+1,07
$\text{Pt}^{2+} + 2e^- \rightleftharpoons \text{Pt}$	+1,20
$\text{MnO}_2 + 4\text{H}^+ + 2e^- \rightleftharpoons \text{Mn}^{2+} + 2\text{H}_2\text{O}$	+1,23
$\text{O}_2(\text{g}) + 4\text{H}^+ + 4e^- \rightleftharpoons 2\text{H}_2\text{O}$	+1,23
$\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6e^- \rightleftharpoons 2\text{Cr}^{3+} + 7\text{H}_2\text{O}$	+1,33
$\text{Cl}_2(\text{g}) + 2e^- \rightleftharpoons 2\text{Cl}^-$	+1,36
$\text{MnO}_4^- + 8\text{H}^+ + 5e^- \rightleftharpoons \text{Mn}^{2+} + 4\text{H}_2\text{O}$	+1,51
$\text{H}_2\text{O}_2 + 2\text{H}^+ + 2e^- \rightleftharpoons 2\text{H}_2\text{O}$	+1,77
$\text{Co}^{3+} + e^- \rightleftharpoons \text{Co}^{2+}$	+1,81
$\text{F}_2(\text{g}) + 2e^- \rightleftharpoons 2\text{F}^-$	+2,87

Increasing oxidising ability/*Toenemende oksiderende vermoë*

Increasing reducing ability/*Toenemende reduserende vermoë*