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GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PROVINCIAL EXAMINATION

JUNE 2023

GRADE 11

PHYSICAL SCIENCES: CHEMISTRY

PAPER 2

TIME: 1 hour

MARKS: 50

6 pages + 1 data sheet

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INSTRUCTIONS AND INFORMATION

1. Write your name in the appropriate space on the ANSWER BOOK.
2. This question paper consists of FOUR questions. Answer ALL 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 subquestions, for example between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable calculator.
7. You may use appropriate mathematical instruments.
8. You are advised to use the attached DATA SHEET.
9. Show ALL formulae and substitutions in ALL calculations.
10. Round-off your FINAL numerical answers to a minimum of TWO decimal places.
11. Give brief motivations, discussions, et cetera, where required.
12. Write neatly and legibly.

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QUESTION 1: 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 (1.1 to 1.4) in the ANSWER BOOK, for example 1.5 A.

1.1 The tendency of an atom to attract a bonding pair of electrons is referred to as …

A electron affinity.
B electronegativity.
C polarity.
D valency. (2)

1.2 Which of the following compounds contains ionic bonds?

A CH_4
B CO_2
C $MgCl_2$
D O_2 (2)

1.3 The type of intermolecular forces that exist in a water molecule are called …

A London forces.
B ion-ion forces.
C ion-dipole forces.
D hydrogen bonds. (2)

1.4 What type of IMF are present in all substances, regardless of polarity?

A Dipole-dipole forces
B Dispersion/London forces
C Ion-dipole forces
D Hydrogen bonding (2)
[8]

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QUESTION 2: (Start on a new page.)

2.1 Hydrogen cyanide (HCN) is a very poisonous compound used in the mining of gold and the manufacturing of plastic and poison.

2.1.1 Define a *chemical bond*. (2)

2.1.2 Draw the Lewis structure for HCN. (2)

2.1.3 What is the shape of the HCN molecule? (2)

2.1.4 What is the polarity of the HCN molecule? Write only POLAR or NON-POLAR. (1)

2.2 The table below indicates the values of the bond length and bond energy of the different bonds in HCN.

Bond	Bond length (nm)	Bond energy ($kJ.mol^{-1}$)
CH	0,109	413
CN	0,116	890

2.2.1 Define the term *bond energy*. (2)

2.2.2 Explain why the bond energy of the CN bond is more than the bond energy of the CH bond. (2)

2.2.3 Explain the difference between *the bond length of the CH bond* and *the bond length of the CN bond*. (2)

2.2.4 Will HCN be soluble in water? Write only YES or NO. (1)

2.2.5 Explain the answer to QUESTION 2.2.4 by referring to the polarity and intermolecular forces of the compounds. (3)

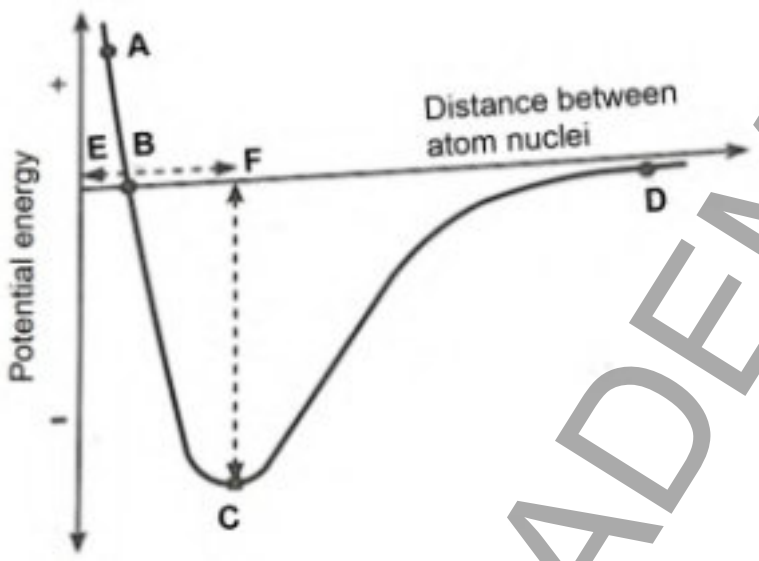
[17]

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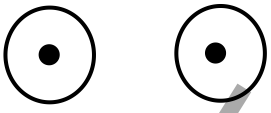
QUESTION 3: (Start on a new page.)

The graph below shows the change in potential energy as two hydrogen atoms approach one another.



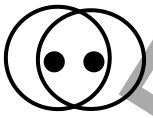
3.1 Match the diagram 3.1.1 – 3.1.3 below to point **A**, **B**, **C** or **D** that illustrates the distance between the hydrogen nuclei to the points on the energy diagram.

3.1.1



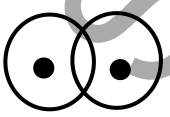
(1)

3.1.2



(1)

3.1.3



(1)

3.2 What is represented by **EF** and **FC** respectively? (2)

3.3 Which point on the graph represents the position of greatest stability? (1)

3.4 Which ONE of the letters **A**, **C** or **D**, represents the formation of the H_2 molecule. Give a reason for your answer. (2)

3.5 Which factor will cause the potential energy to decrease as the two atoms approach one another? (2)

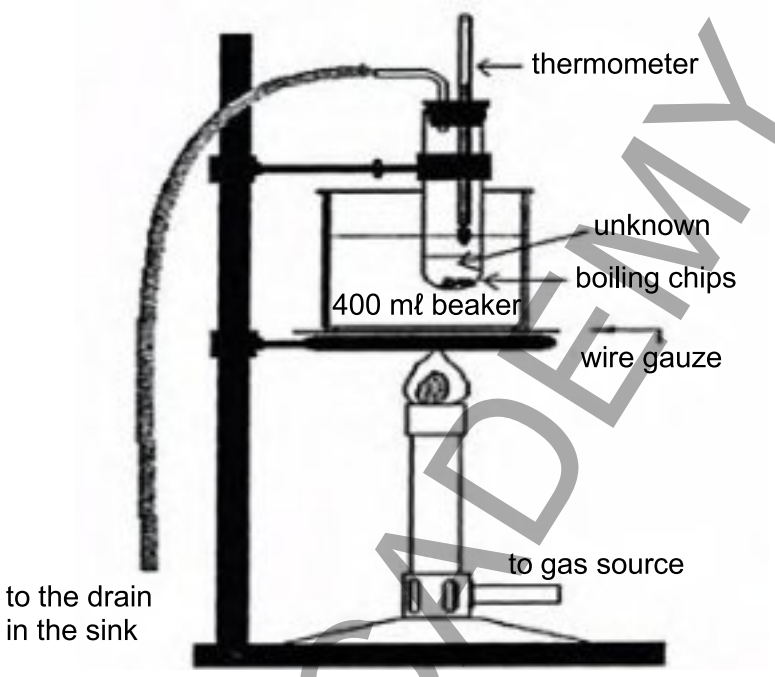
[10]

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QUESTION 4: (Start on a new page.)

The grade 11 learners perform an experiment to determine the effect of intermolecular forces on the boiling point. Learners heated equal amounts of different liquids (acetone, distilled water, ethanol, and methylated spirits) in a water bath over a bunsen burner. It was found that the distilled water took longer to boil.



4.1 Give an investigative question for this investigation. (2)

4.2 For this investigation give the:

4.2.1 Independent variable (1)

4.2.2 Controlled variable (1)

4.3 Why are the liquids heated in a water bath? (1)

4.4 Which liquid has the lowest vapour pressure? Explain your answer. (2)

4.5 State your conclusion for this investigation. (2)

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

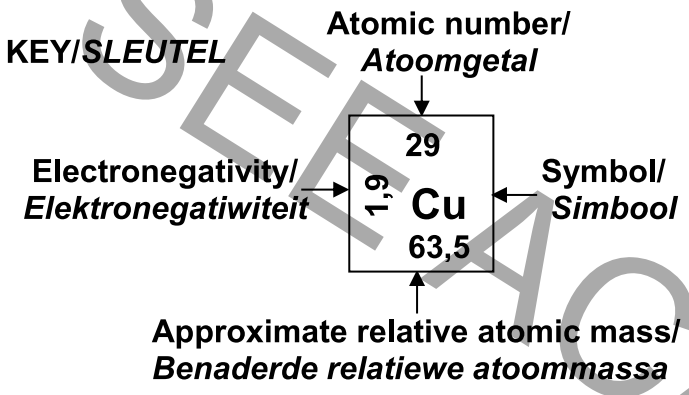
4.7 Explain the difference in boiling points of acetone and distilled water in terms of intermolecular forces and energy. (4)
[15]

TOTAL: 50

END

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



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 Li 7	1,5 Be 9											2,0 B 11	2,5 C 12	3,0 N 14	3,5 O 16	4,0 F 19	10 Ne 20
0,9 Na 23	1,2 Mg 24											1,5 Aℓ 27	1,8 Si 28	2,1 P 31	2,5 S 32	3,0 Cℓ 35,5	18 Ar 40
0,8 K 39	1,0 Ca 40	1,3 Sc 45	1,5 Ti 48	1,6 V 51	1,6 Cr 52	1,5 Mn 55	1,8 Fe 56	1,8 Co 59	1,8 Ni 59	1,9 Cu 63,5	1,6 Zn 65	1,6 Ga 70	1,8 Ge 73	2,0 As 75	2,4 Se 79	2,8 Br 80	36 Kr 84
0,8 Rb 86	1,0 Sr 88	1,2 Y 89	1,4 Zr 91	41 Nb 92	1,8 Mo 96	1,9 Tc	2,2 Ru 101	2,2 Rh 103	2,2 Pd 106	1,9 Ag 108	1,7 Cd 112	1,7 In 115	1,8 Sn 119	1,9 Sb 122	2,1 Te 128	2,5 I 127	54 Xe 131
0,7 Cs 133	0,9 Ba 137	57 La 139	1,6 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 Tℓ 204	1,8 Pb 207	1,9 Bi 209	2,0 Po	2,5 At	86 Rn
0,7 Fr	0,9 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

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