HILLCREST HIGH SCHOOL

PHYSICAL SCIENCE **GRADE 11** **CLASS TEST**

IMF JUNE 2021

MARK TOTAL: 51

INSTRUCTIONS:

- **Answer all questions**
- **Non-programmable calculators may be used**
- **Answers must be rounded off to TWO decimal places or written in scientific notation where two decimal places are not possible**

Question 1

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 (2.1 – 2.3) on your answer sheet.

1.1 Which ONE of the following statements concerning Intermolecular forces is TRUE?

They:

A hold atoms together in a molecule
B hold molecules together in a solid, liquid or gas phase
C are formed by sharing electrons
D are formed by transferring electrons (2)

Question 2

In the table below, the melting points and boiling points of different substances at standard pressure are given. Use this information to answer the questions which follow.

Substance	Melting point °C	Boiling point °C
He	-272	-269
HBr	−86.9	−66.8
CCl_4	-23	77
CO_2	Sublimes at -79	
CH_4	-184	-162
H_2O	0	100

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2.1 In which ONE of the substances will the weakest intermolecular forces exist in the solid phase? **Choose only the CORRECT answer from the options below.**

He **HBr** **CCl_4** **CO_2** **CH_4** **H_2O** (1)

2.2 Name the type of intermolecular forces that exist between the following:
Be careful with spelling and typos or your answer will be marked incorrect.

2.2.1 The molecules of CO_2 (1)

2.2.2 The molecules of H_2O (1)

2.3 Which one of the substances is a liquid at - 10°C? **Choose only the CORRECT answer from the options below.**

He **HBr** **CCl_4** **CO_2** **CH_4** **H_2O** (1)

2.4 Explain the difference between the melting and boiling points of HBr and H_2O. (4)

Choose only the statements that are correct and apply to the answer for QUESTION 2.4.

HBr has van der Waal's London forces between its molecules.

HBr has van der Waal's dipole-dipole forces between its molecules.

HBr has strong hydrogen bonding between its molecules.

H_2O has van der Waal's London forces between its molecules.

H_2O has van der Waal's dipole-dipole forces between its molecules.

H_2O has strong hydrogen bonding between its molecules.

Dipole-dipole forces are stronger than hydrogen bonding.

Dipole-dipole forces are stronger than London forces.

Hydrogen bonding is stronger than dipole-dipole forces.

Hydrogen bonding is stronger than London forces.

Therefore the melting and boiling point of H_2O is lower than that of HBr.

Therefore the melting and boiling point of H_2O is higher than that of HBr. **[8]**

Question 3

3.1 Define the term *electronegativity.*
Fill in the missing words.

The tendency of an to attract the pair of in a molecule. (3)

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3.2 Consider the following compounds and answer the questions that follow:

$C\ell_2$ **H_2O** **$PC\ell_3$**

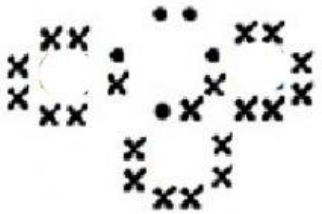
3.2.1 Use the difference in electronegativity to identify the intramolecular bonds in each of the compounds above. Show all calculations. (6)

$C\ell_2$: ΔEN = Pure covalent / Polar covalent / Ionic

H_2O: ΔEN = Pure covalent / Polar covalent / Ionic

$PC\ell_3$: ΔEN = Pure covalent / Polar covalent / Ionic

3.2.2 Fill in the symbols for the elements in the the Lewis diagram for $PC\ell_3$ below:



Name the shape of the $PC\ell_3$ molecule:
$PC\ell_3$ will be a polar / non-polar molecule because the bonds are polar / non-polar and the molecular shape is symmetrical / asymmetrical. (5)

3.2.3 Consider the compounds **$CHC\ell_3$** and **$CC\ell_4$**.

Give the shape of these molecules:

$CHC\ell_3$ has polar / non-polar bonds and is a polar / non-polar molecule.

$CC\ell_4$ has polar / non-polar bonds and is a polar / non-polar molecule.

Give **one word** that explains the difference in polarity between these 2 molecules: (6)

[20]

Question 4

4.1 The graph shows the change in energy that takes place when a hydrogen (H) atom approaches a chlorine ($C\ell$) atom.

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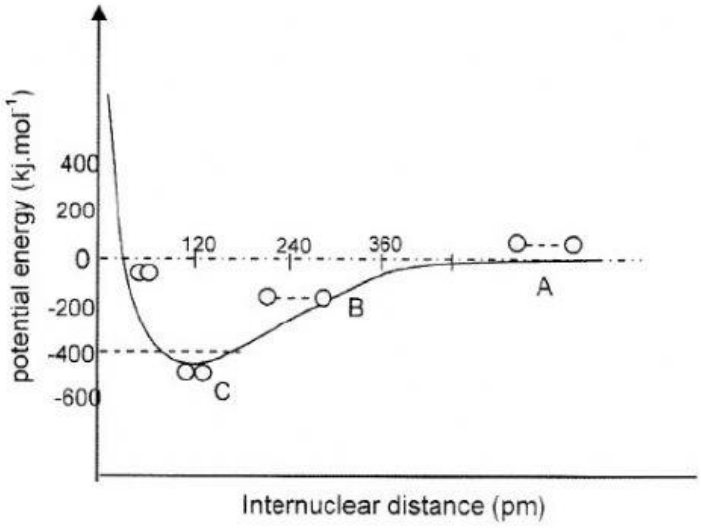

4.1.1 What is bond energy? (6)
Energy required to in of

4.1.2 How much energy is released when the H – Cℓ bond forms? kJ.mol^{-1} (1)

4.1.3 What is the bond length, in pm, of the H – Cℓ bond? pm (1)

4.1.4 Why does the potential energy decrease from point **A** to point **C**? (2)
There is an attractive / repulsive force between the nucleus of one atom and the of the other atom.

4.1.5 Which one of the bonds, Cℓ – Cℓ or H – Cℓ, will have the highest bond energy? Cℓ – Cℓ or H – Cℓ (1)

4.2 Name the bond or force that is overcome when:

4.2.1 gaseous HCℓ is converted to hydrogen and chlorine atoms (1)

4.2.2 liquid HCℓ vapourises (1)

4.3 HCℓ, HBr and HF are three compounds with the same geometric shape but different boiling points. Arrange these compounds in order of INCREASING boiling point. (3)

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[16]

Question 5

In an investigation into the relationship between the bond energy and bond length a student looked up the bond energy between various pairs of atoms. He recorded his findings in the table shown below:

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BOND	LENGTH (pm)	ENERGY kJ/mol
C≡C	120	839
C=O	123	804
O=O	121	498
C–C	154	348
O–O	148	145
H–O	96	463
C–O	143	358
H–C	109	413

Consider the combustion of 1 mol methane:

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

5.1 Use the values provided in the table above to calculate the total amount of energy required to break all the bonds in **1 mol** CH_4 and **1 mol** O_2.

Energy required: x C – H = x kJ/mol = kJ/mol

x O = O = x kJ/mol = kJ/mol

Total = kJ/mol **[9]**

TOTAL = 57

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

KEY/*SLEUTEL*

Atomic number / *Atoomgetal*: 29
Electronegativity / *Elektronegatiwiteit*: 1,9
Symbol / *Simbool*: Cu
Approximate relative atomic mass / *Benaderde relatiewe atoommassa*: 63,5

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 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

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