

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
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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 ₂ O	0	100

- 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 CCl₄ CO₂ CH₄ H₂O (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 CO₂ (1)

2.2.2 The molecules of H₂O (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 CCl₄ CO₂ CH₄ H₂O (1)

- 2.4 Explain the difference between the melting and boiling points of HBr and H₂O. (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.

H₂O has van der Waal's London forces between its molecules.

H₂O has van der Waal's dipole-dipole forces between its molecules.

H₂O 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 H₂O is lower than that of HBr.

Therefore the melting and boiling point of H₂O 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)

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



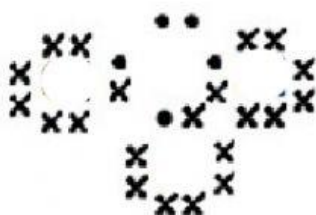
3.2.1 Use the difference in electronegativity to identify the intramolecular bonds in each of the compounds above. Show all calculations. (6)

C_2 : $\Delta\text{EN} =$ Pure covalent / Polar covalent / Ionic

H_2O : $\Delta\text{EN} =$ Pure covalent / Polar covalent / Ionic

PCl_3 : $\Delta\text{EN} =$ Pure covalent / Polar covalent / Ionic

3.2.2 Fill in the symbols for the elements in the the Lewis diagram for PCl_3 below:



Name the shape of the PCl_3 molecule:

PCl_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 CHCl_3 and CCl_4 .

Give the shape of these molecules:

CHCl_3 has polar / non-polar bonds and is a polar / non-polar molecule.

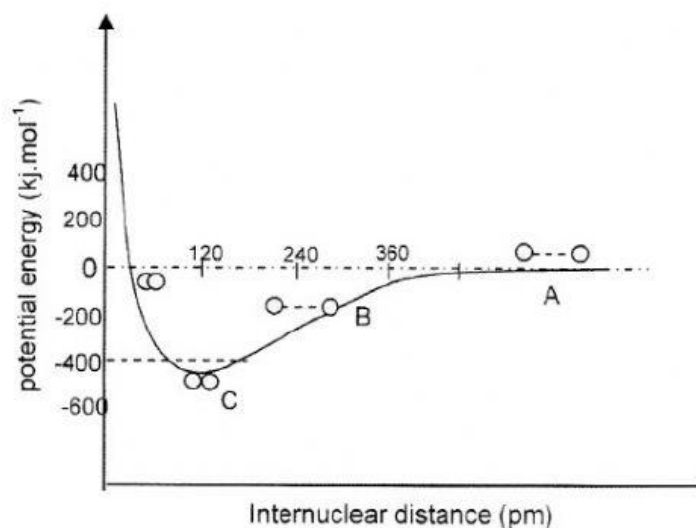
CCl_4 has polar / non-polar bonds and is a polar / non-polar molecule.

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 (Cl) atom.



- 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:

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:



- 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** CH₄ and **1 mol** O₂.

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

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)
1 H 1																	2 He 4
3 Li 7	4 Be 9											5 B 11	6 C 12	7 N 14	8 O 16	9 F 19	10 Ne 20
11 Na 23	12 Mg 24											13 Al 27	14 Si 28	15 P 31	16 S 32	17 Cl 35,5	18 Ar 40
19 K 39	20 Ca 40	21 Sc 45	22 Ti 48	23 V 51	24 Cr 52	25 Mn 55	26 Fe 56	27 Co 59	28 Ni 59	29 Cu 63,5	30 Zn 65	31 Ga 70	32 Ge 73	33 As 75	34 Se 79	35 Br 80	36 Kr 84
37 Rb 86	38 Sr 88	39 Y 89	40 Zr 91	41 Nb 92	42 Mo 96	43 Tc 98	44 Ru 101	45 Rh 103	46 Pd 106	47 Ag 108	48 Cd 112	49 In 115	50 Sn 119	51 Sb 122	52 Te 128	53 I 127	54 Xe 131
55 Cs 133	56 Ba 137	57 La 139	58 Ce 140	59 Pr 141	60 Nd 144	61 Pm 147	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	72 Hf 178
87 Fr 226	88 Ra 226	89 Ac 227	90 Th 232	91 Pa 231	92 U 238	93 Np 237	94 Pu 244	95 Am 243	96 Cm 247	97 Bk 247	98 Cf 251	99 Es 252	100 Fm 257	101 Md 288	102 No 289	103 Lr 260	104 Rf 261