ALEXANDER ROAD HIGH SCHOOL

MAY 2021	**PHYSICAL SCIENCES CONTROL TEST**	50 MINUTES
MH	**GRADE 11**	TOTAL = 45

Instructions:

- The question paper consists of 6 questions.
- Answer all the questions.
- Answer section A on the answer sheet provided AND section B on folio sheets.
- A non-programmable calculator may be used.
- Number the answers correctly according to the numbering system.
- Round off to two (2) decimal places where necessary.
- A formula sheet has been provided at the end of the question paper.
- A periodic table has been provided on the back of the answer sheet.

SECTION A

(answer on the answer sheet)

QUESTION 1:

Four possible options are provided as answers to the following questions. Each question has only one correct answer. Choose the correct answer and write the letter (A – D) next to the relevant question number (1.1 – 1.4) on the answer sheet.

1.1 Intermolecular forces …

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

1.2 Hydrogen bonds and London forces have a common characteristic in that they …

A. are both stronger than covalent bonds.
B. both occur between non-polar molecules.
C. both occur between polar molecules.
D. are both intermolecular forces.

1.3 Which ONE of the following bromides will most likely have the most ionic character?

A. LiBr

B. CsBr

C. $BeBr_2$

D. $CaBr_2$

1.4 In which of the following cases will the solute dissolve in the solvent?

A. NaCl in CCl_4

B. O_2 in H_2O

C. CCl_4 in H_2O

D. $LiNO_3$ in H_2O

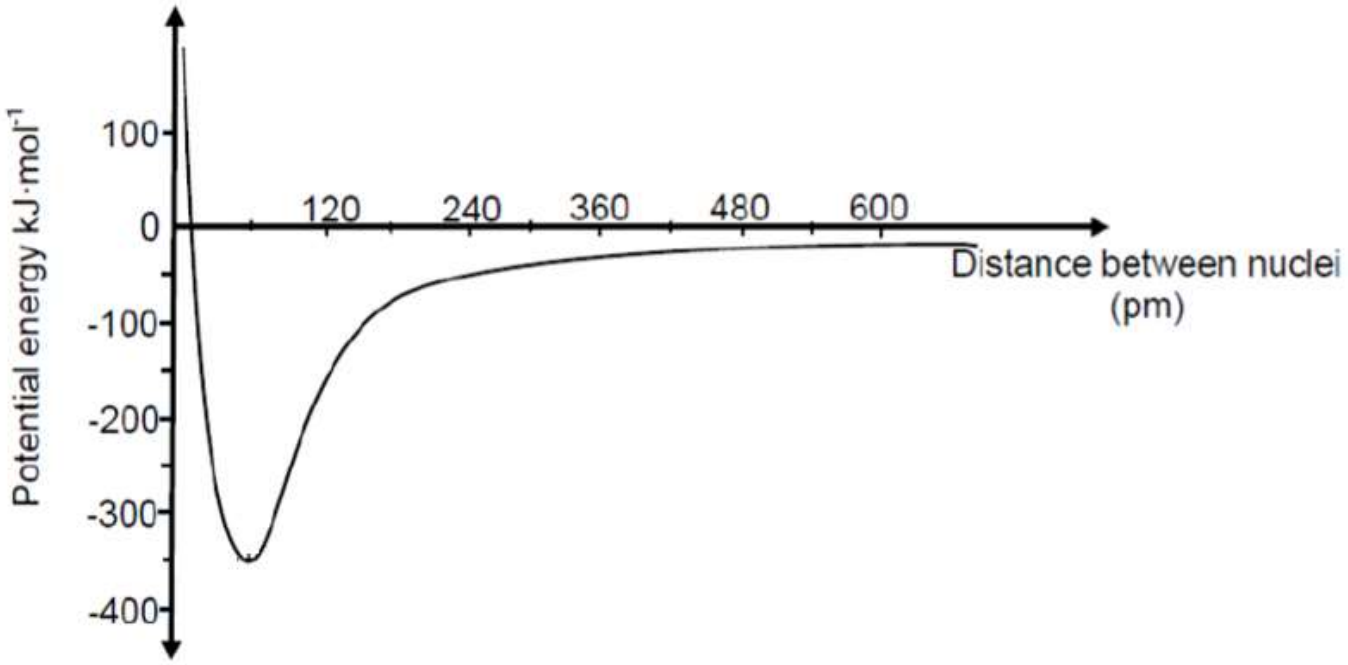
TOTAL SECTION A = [8]

SECTION B

(answer on folio paper)

QUESTION 2:

The graph below shows the change in energy that takes place when a hydrogen (H) atom approaches a bromine (Br) atom.



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

2.2 How would the bond length of HCl compare to that of HBr?
Write only LONGER THAN, SHORTER THAN or EQUAL TO. (1)

2.3 Give a reason for your answer in 2.2. (1)

2.4 Hence, how will the *bond energy* of HCl compare to that of HBr?
Write only HIGHER THAN, LOWER THAN or EQUAL TO. (1)

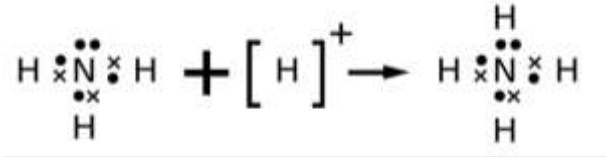
2.5 From the graph, give the *bond energy* of HBr. (1)

[6]

QUESTION 3:

3.1 Draw the Couper diagram for NH_3. (1)

3.2 Consider the following and answer the questions that follow:



3.2.1 Give the name of the product. (1)

3.2.2 Name the type of bond formed between NH_3 and the H^+ ion. (1)

[3]

QUESTION 4:

The bond energies for numerous bonds are given in kJ.mol^{-1}. Answer the questions that follow.

1	2	3	4	5	6
H – H	436	C – C	348	F – F	155
H – C	413	C – Cl	326	Cl – Cl	243
H – N	389	C – O	335	Br – Br	190
H – O	463	Cl – O	205	I – I	149
H – Cl	431	H – S	338	H – Br	346

Double bonds (bond order 2)		Triple bonds (bond order 3)	
O = O	498	N ≡ N	941
C = C	619	C ≡ C	845
C = O	707		

4.1 Draw the Lewis diagrams for:

4.1.1 CH_4 (2)

4.1.2 CO_2 (2)

4.2 Calculate the *electronegativity difference* for the CO bond in CO_2. (2)

4.3 What is the polarity of the CO_2 molecule? Write only POLAR or NON-POLAR. (1)

4.4 Calculate the amount of energy needed to break all bonds in CH_4 (in kJ.mol^{-1}). (2)

4.5 How much energy will be released when 2,5 moles of CO_2 form? (2)

4.6 Determine by calculation, whether the reaction of

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

is endothermic or exothermic. (6)

[17]

QUESTION 5:

The reaction below is used in the Haber process to manufacture ammonia.

$$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$$

The boiling points of the substances in the reaction are as follows:

SUBSTANCE	BOILING POINT (°C)
H_2	-252,9
N_2	-195,8
NH_3	-33,3

5.1 Refer to the intermolecular forces and explain the difference in boiling points of H_2 and NH_3. (3)

5.2.1 Give the *formula* of the molecule in the table that will have the highest vapour pressure. (1)

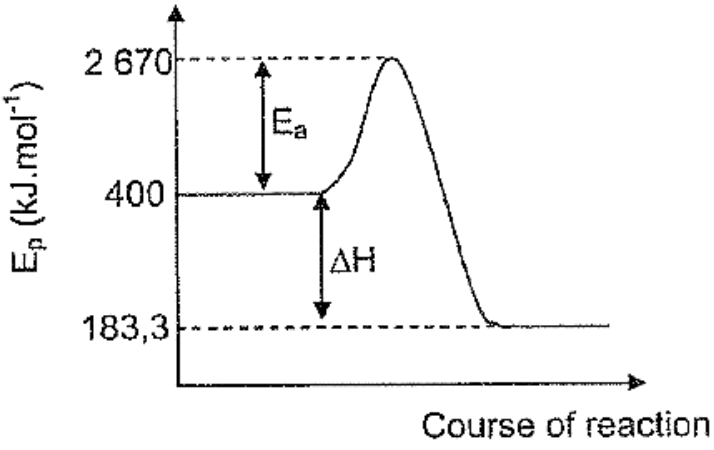
5.2.2 Give a reason for your answer in 5.2.1. by referring to the boiling points. (2)

[6]

QUESTION 6:

The sketch below represents the potential energy graph for the reaction

$$4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$$



6.1 Define *activation energy*. (2)

6.2 Without calculating the *heat of the reaction*, state whether the reaction is EXOTHERMIC OR ENDOTHERMIC. (1)

6.3 Give a reason for your answer in 6.2. (1)

6.4 Make a rough sketch of the graph given and indicate the reaction path with a catalyst present. (1)

[5]

TOTAL SECTION B = [37]

Formula Sheet

Physical Constants:

Name	Symbol	Value
Avogadro's constant	N_A	$6{,}02 \times 10^{23}\ mol^{-1}$
Molar gas constant	R	$8{,}31\ J.K^{-1}.mol^{-1}$
Standard pressure	p^{θ}	$1{,}013 \times 10^{5}\ Pa$
Molar gas volume at STP	V_m	$22{,}4\ dm^3.mol^{-1}$
Standard temperature	T^{θ}	273 K

Formulae:

CHEMISTRY

$\frac{p_1V_1}{T_1} = \frac{p_2V_2}{T_2}$	$pV = nRT$
$n = \frac{m}{M}$	$n = \frac{N}{N_A}$
$n = \frac{V}{V_m}$	$c = \frac{n}{V}$ or $c = \frac{m}{MV}$