UNIVERSITI
TEKNOLOGI
PETRONAS

EXTENDED ASSIGNMENT
MAY 2020 SEMESTER

COURSE : FBC0015 – CHEMISTRY I

DATE : 1 SEPTEMBER 2020

TIME : 9.00 AM (24 hours)

INSTRUCTIONS TO CANDIDATES

1. The **Extended Assignment (EA)** is an open-book assessment format. Students can refer to online resources, learning materials, textbooks, and other reading materials to answer the questions posed in the assessment.
2. Answer **ALL** questions.
3. The duration to complete and submit the EA is **TWENTY-FOUR (24) HOURS.**
4. Only **ONE (1)** duly completed EA submission is permitted.
5. **MAXIMUM** file size for your EA submission to be uploaded in ULearn is **20MB** in **PDF format**.

Note : There are **SIX (6)** pages in this Question Booklet including the cover page.

EXTENDED ASSIGNEMENT

[100 MARKS]

1. a. Discuss the physical and chemical compositions of **ALL** the substances in **TABLE Q1**. Hence, provide **ONE (1)** reaction that can occur from any of the substances with elaboration.

TABLE Q1

Substance	Formula	State of Matter (25°C, 1 atm)
Water	H_2O	Liquid
Copper	Cu	Solid
Ethanol	C_2H_5OH	Liquid
Carbon dioxide	CO_2	Gas
Sodium chloride	NaCl	Solid

[10 marks]

b. Using your knowledge of chemistry, comment on at least **TWO (2)** different elements in periodic table by comparing the properties and position of your chosen elements. Elaborate the differences.

[10 marks]

c. Scientists in industry work to maximize the yield of reactions and maximize profits. However, under experimental conditions and especially in large-scale processes, many factors result in a reduced yield of products.

For example, in the manufacture of phosphoric acid, molten elemental phosphorus is oxidized and then hydrated using excess water according to the following equation:

$$P_4\,(l) + 5O_2\,(g) + 6H_2O\,(l) \longrightarrow 4H_3PO_4\,(aq)$$

By using your knowledge in chemistry, demonstrate the difference between the limiting reagent, excess reagent, and theoretical yield by referring to the above equation. Propose any relevant calculation to support your answer. Hence, explain on the possible factors that could affect the yield of products.

[10 marks]

2. a. Alkanes are hydrocarbons in which the carbon atoms are held together by single bonds. The general formula is C_nH_{2n+2} for molecules which do not contain ring structures. Alkanes are important raw materials of the chemical industry for various applications. **TABLE Q2** shows the physical properties of some alkanes.

TABLE Q2

Molecular Name	Formula	Melting Point (°C)	Boiling Point (°C)	Density at 20°C (g/L)	Physical State at 20°C
Methane	CH_4	-182	-164	0.668	Gas
Ethane	C_2H_4	-183	-89	1.265	Gas
Propane	C_3H_8	-190	-42	1.867	Gas
Butane	C_4H_{10}	-138	-1	2.493	Gas
Pentane	C_5H_{12}	-130	36	0.626	Liquid
Hexane	C_6H_{14}	-95	69	0.659	Liquid
Octane	C_8H_{18}	-57	125	0.703	Liquid
Decane	$C_{10}H_{22}$	-30	174	0.730	Liquid

i. Describe the reaction that takes place when methane is burned in the presence of excess oxygen. Using the information on bond dissociation energy, prove that the reaction is exothermic.

[10 marks]

ii. Apart from heating and cooking purposes, alkanes can also be utilized as lubricating oils for engine. Using your knowledge of chemistry, explain your viewpoint on the properties of high molecular weight of alkanes in lubricating oils.

[10 marks]

b. The most common type of diesel fuel is petroleum-based, but alternative resources that are not derived from petroleum, such as biodiesel are increasingly being developed and adopted.

"Waste cooking oil can be used to produce biodiesel."

Applying your knowledge in chemistry, discuss the statement.

[10 marks]

3. a. Assuming you have just reached a mountaintop and decided to eat a hardboiled egg. Surprisingly, during the preparation, the water seems to boil more quickly than usual. However, the egg is still not completely cooked even after being placed in the boiling water for 10 minutes. By using your knowledge of chemistry, explain the occurrence by considering the phase diagram viewpoint.

[15 marks]

b. In the human body, various chemical equilibria must be maintained to ensure the physiological well-being. If the surroundings change, the body must adapt in order to keep functioning. A mountaineer may need weeks or even months to acclimatize hypoxia, a deficiency in the amount of oxygen reaching body tissues that causes headache, nausea, extremely fatigue and other discomforts, while climbing the Mount Everest. In serious cases, the victim may slip into a coma and die if not treated quickly. Assuming the combination of oxygen and haemoglobin (Hb) molecules in the human body is represented as follows:

$$Hb\ (aq) + O_2\ (aq) \rightleftharpoons HBO_2\ (aq)$$

Explain how the mountaineers can survive at high altitude areas by using this chemical equilibrium equation.

[15 marks]

c. The ionization of monoprotic organic acid with a K_a of 6.7×10^{-4} is 3.5%. Calculate the molecular weight of this monoprotic organic acid if 100 g of it is dissolved in 1 L of water. Hence, suggest and draw **ONE (1)** possible chemical structure of monoprotic organic acid having the calculated molecular weight.

[10 marks]

-END OF PAPER-