UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2014/2015

COURSE NAME	:	SURFACE SCIENCE
COURSE CODE	:	BWC 31003
PROGRAMME	:	3 BWC
EXAMINATION DATE	:	JUNE 2015 / JULY 2015
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

Q1 (a) Give definition of the term **"surface"**.

(2 marks)

(b) **"Interface"** can be categorized into THREE different types of phase reaction. List all the three types of interface and give ONE example for each interface.

(6 marks)

(c) Explain why some surface tends to be **"heterogeneous surface"**?

(6 marks)

(d) (i) A schematic representation of "heterogeneous surface" is shown in the following **Figure Q1(d)**. Give appropriate names of the surface terms, A, B and C.

(ii) Explain the chemical bonding for each surface A, B and C. (with respect to the activation energy and thermodynamic properties)

(6 marks)

Q2 (a) Differentiate the terms **"surface chemistry"** and **"surface physics"**.

(4 marks)

(b) Differentiate the term of **"ion sputtering"** and **"chemical etch"**.

(4 marks)

(c) From **Q2(b)**, propose which sample preparation technique is suitable to be performed under vacuum condition, and explain why?

(6 marks)

(d) (i) What is **"surface energy"**?

(ii) Compose this surface energy in terms of Gibbs free energy equation.

(6 marks)

Q3 (a) Differentiate between the terms **"adsorption"** and **"desorption"**.

(4 marks)

(b) Oxide formation on the material surface is due to two processes which are **physisorption** and **chemisorption**. Differentiate these two processes.

(4 marks)

(c) Monolayer oxide coverage on the material surface is depend on surface coverage, θ and gas pressure, *p*. Using **Langmuir adsorption isotherm**, summarize the mechanism of this monolayer oxide formation .

(4 marks)

(d) (i) The mechanism of surface layer growth on solid material can be describe in three model as illustrated in **Figure Q3(d)**. Give appropriate name of model, X, Y and Z.

(ii) Summarize the mechanism of surface layer growth in **Q3(i)**.

(8 marks)

Q4 (a) Give two reasons why Ultra High Vacuum (UHV) environment is required in surface science experiment.

(4 marks)

(b) Correlate a relationship between vacuum condition with a parameter of pressure, *p* and mean free path, λ.

(4 marks)

(c) Gas exposure on the material surface is defined as a "**Langmuir Exposure**". Define the term **"Langmuir exposure"**?

(4 marks)

(d) Vacuum region can be classified into four categories. Summarize all vacuum regions together with its pressure range and pumping system.

(8 marks)

Q5 (a) Surface sensitivity is one of the crucial parameters in most of the surface science analytical techniques. Justify the importance of surface sensitivity.

(4 marks)

(b) Differentiate between X-ray Photoelectron Spectroscopy (XPS) and Auger Electron Spectroscopy (AES).

(6 marks)

(c) **From Q2(b)**, compare the surface sensitivity between XPS and AES? Please justify your answer.

(4 marks)

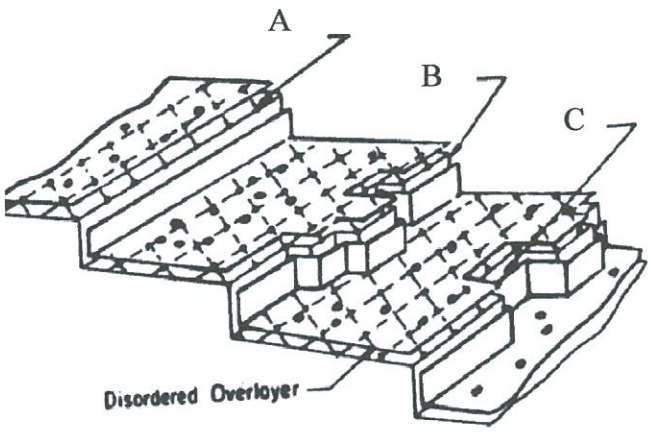
(d) A schematic diagram of XPS analysis chamber system components are illustrated in **Figure Q5 (d)**. Classify X, Y, and Z components and characterize the functions for each component.

(6 marks)

- END OF QUESTION –

FINAL EXAMINATION

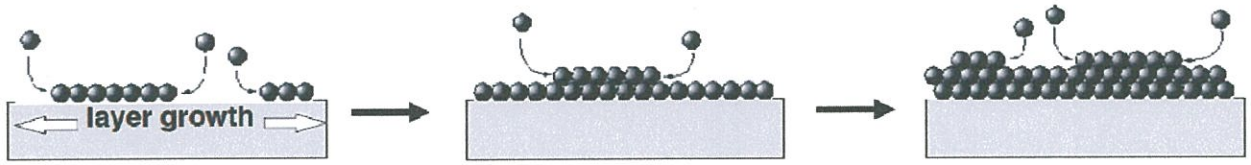
SEMESTER / SESSION	: SEM II / 2014/2015	PROGRAMME	: 3 BWC
COURSE	: SURFACE SCIENCE	COURSE CODE	: BWC 31003



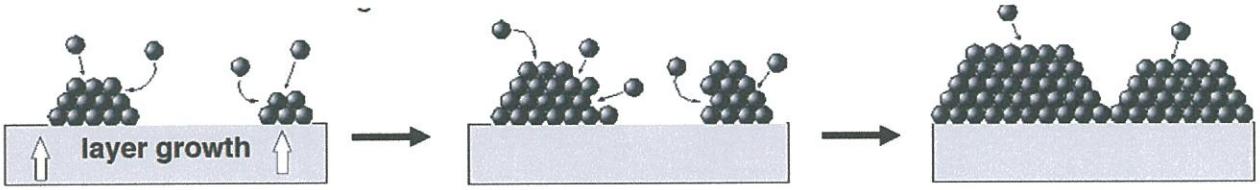
FIGURES Q1(d)

FINAL EXAMINATION

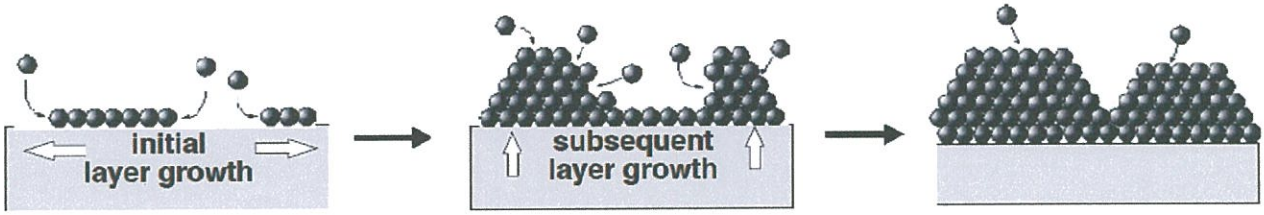
SEMESTER / SESSION	: SEM II / 2014/2015	PROGRAMME	: 3 BWC
COURSE	: SURFACE SCIENCE	COURSE CODE	: BWC 31003



Model X



Model Y



Model Z

FIGURES Q3(d)

FINAL EXAMINATION

SEMESTER / SESSION	: SEM II / 2014/2015	PROGRAMME	: 3 BWC
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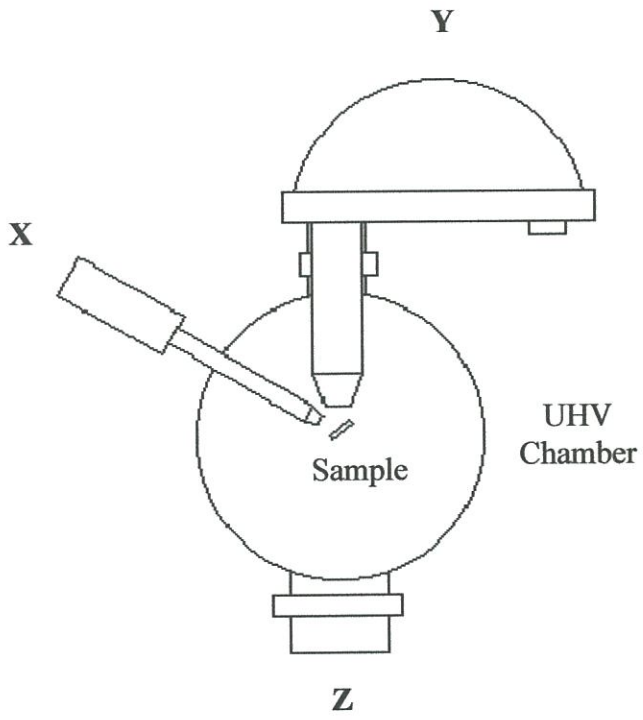

FIGURES Q5(d)