



THE OPEN UNIVERSITY OF SRI LANKA
B.Sc/B.Ed DEGREE PROGRAMME - 2012/2013
Level 4 - CMU2122/CME4122
INORGANIC CHEMISTRY
ASSIGNMENT TEST II (NBT)

14th March 2013 (Thursday)

4.00 – 5.30 p.m

Part A - 20 Multiple Choice Questions (60 Marks)

Answer all questions

Select the most correct answer to each question given below and mark a cross **X** over the answer on the given answer sheet. Any answer with more than one **X** will not be counted.

Avogadro constant, L	= 6.023 x 10 ²³ mol ⁻¹
Velocity of light, c	= 3 x 10 ⁸ m s ⁻¹
Mass of a hydrogen atom	= 1.007825 u
Mass of a neutron	= 1.008665 u
1 u	= 1.661 x 10 ⁻²⁷ kg
1 MeV	= 1.6021 x 10 ⁻¹³ J

- What will be the product of β^- decay by ${}^{14}_6\text{C}$?
1) ${}^{13}_7\text{N}$ 2) ${}^{13}_6\text{C}$ 3) ${}^{14}_7\text{N}$ 4) ${}^{14}_5\text{B}$ 5) ${}^{13}_5\text{B}$
- Which of the following comments is true about (4n+1) decay series?
1) ${}^{232}_{90}\text{Th}$ is the parent member of the series. 2) It involves emission of α only
3) It involves emission of β only 4) The series ends with ${}^{209}_{83}\text{Bi}$
5) ${}^{226}\text{Ra}$ is a member of the decay series.
- The half-life ($t_{1/2}$) of carbon-11 is 20.4 min. What percentage of the original 1.0 mg sample of carbon-11 is left after 1 hour 42 minutes ?
1) 25 2) 12.5 3) 3.125 4) 6.25 5) 37.5
- Two of the following nuclides will be expected to be stable.
(a) ${}^{18}_9\text{F}$ (b) ${}^{20}_{10}\text{Ne}$ (c) ${}^{16}_8\text{O}$ (d) ${}^{11}_6\text{C}$
The answer is
1) (a) and (b) only 2) (b) and (c) only 3) (c) and (d) only
4) (d) and (a) only 5) (a), (b) and (c) only
- Identify the type of nuclear reaction: ${}^{32}_{15}\text{P} \rightarrow {}^{32}_{16}\text{S} + ?$
1) α - decay 2) electron emission 3) positron emission
4) electron capture 5) γ emission

6. Identify from the following the type of nuclear decay process(s) that the radionuclide,

8_5B may undergo:

- (a) electron emission (b) electron capture (c) positron emission

The answer is

- 1) (a) only 2) (b) only 3) (c) only
 4) (a) and (b) only 5) (b) and (c) only

7. Which one of the following radionuclides will undergo electron emission?

- 1) ${}^{20}_9F$ 2) ${}^{20}_{10}Ne$ 3) ${}^{15}_8O$ 4) ${}^{11}_6C$ 5) ${}^{13}_7N$

8. Identify the type of nuclear reaction: ${}^2_1H + ? \rightarrow {}^4_2He + {}^1_0n$

- 1) Electron capture 2) neutron activation 3) fusion
 4) chain reaction 5) fission

9. Indicate the part/system of the body investigated using iron-59 as a radiotracer.

- 1) eyes 2) thyroid 3) red blood cells 4) lungs 5) heart

10. A piece of charcoal from a prehistoric site is found to emit 3.85 β particles per minute per gram of charcoal. Each gram of carbon in living tissue has a constant β ray activity of 15.3 disintegration per minute (dpm). The age of the campsite is

- 1) 5700 y 2) 11400 y 3) 4950 y 4) 2475 y 5) 4798 y

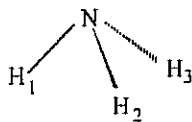
11. Consider the following statements.

- (a) Symmetry is a *quality* of an object.
 (b) Symmetry is a *quantity* related to an object.
 (c) An operational definition *always* involves a procedure.

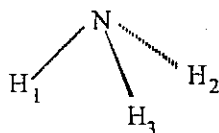
The **correct** statements, out of (a), (b) and (c) above, are

- 1) (a) and (b) only. 2) (a) and (c) only. 3) (b) and (c) only.
 4) All (a), (b) and (c). 5) None of the answers (1), (2), (3) or (4), is correct.

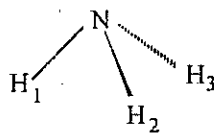
12. Pick the configuration/s which is/are **possibly** equivalent to the following configuration of ammonia molecule.



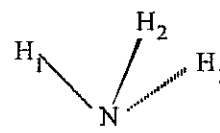
out of (i), (ii) and (iii) given below.



(i)



(ii)



(iii)

- 1) (i) only. 2) (ii) only. 3) (i) and (ii) only.
 4) (i), and (iii) only 5) All (i), (ii) and (iii).

13. Consider the following statements.

- (a) An equivalent configuration is a special example of an identical configuration.
 (b) An identical configuration is a special example of an equivalent configuration.
 (c) There is no relationship between an equivalent configuration and an identical configuration.

The **correct** statements, out of (a), (b) and (c) above, are

- 1) (a) and (b) only. 2) (a) and (c) only. 3) (b) and (c) only.
 4) All (a), (b) and (c). 5) None of the answers (1), (2), (3) or (4), is correct.

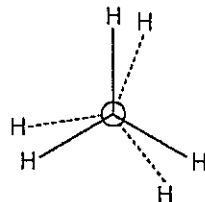
14. A symmetry operation

- (a) always carries the nuclei of a molecule from one configuration to an identical configuration.
 (b) is always carried out about a plane, straight line or a point.
 (c) always carries the nuclei of a molecule from one configuration to an equivalent configuration.

The **correct** statements, out of (i), (ii) and (iii) above, are

- 1) (a) and (b) only. 2) (a) and (c) only. 3) (b) and (c) only.
 4) All (a), (b) and (c). 5) None of the answers (1), (2), (3) or (4), is correct.

15. Consider the following statements about ethane in neither staggered nor eclipsed conformation, the Newmann projection formula of which is given below.



- (a) C-C bond axis is a C_3 axis.
 (b) The molecule has three C_2 axes perpendicular to the C-C bond axis.
 (c) C-C bond axis is an S_3 axis.

The **correct** statements, out of (i), (ii) and (iii) above, are

- 1) (a) and (b) only. 2) (a) and (c) only. 3) (b) and (c) only.
 4) All (a), (b) and (c) 5) None of the answers (1), (2), (3) or (4), is correct.



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B. Sc DEGREE PROGRAMME 2012/2013
CMU2122/CME4122 – INORGANIC CHEMISTRY- LEVEL 4
ASSIGNMENT TEST-II (Part A)

MCQ ANSWER SHEET: Mark a cross (X) over the most suitable answer.

Reg. No.
Marks

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For Examiners Use

Part A	
Part B	
Total %	

Marks

Correct Answers		
Wrong Answers		
Total		

- | | | | | | | | | | | | | | | | | | | | | |
|-----|---|---|---|---|---|---|-----|---|---|---|---|---|---|-----|---|---|---|---|---|---|
| 1. | <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr></table> | 1 | 2 | 3 | 4 | 5 | 2. | <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr></table> | 1 | 2 | 3 | 4 | 5 | 3. | <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr></table> | 1 | 2 | 3 | 4 | 5 |
| 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | | | | | | |
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| 4. | <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr></table> | 1 | 2 | 3 | 4 | 5 | 5. | <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr></table> | 1 | 2 | 3 | 4 | 5 | 6. | <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr></table> | 1 | 2 | 3 | 4 | 5 |
| 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | | | | | | |
| 7. | <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr></table> | 1 | 2 | 3 | 4 | 5 | 8. | <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr></table> | 1 | 2 | 3 | 4 | 5 | 9. | <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr></table> | 1 | 2 | 3 | 4 | 5 |
| 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | | | | | | |
| 10. | <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr></table> | 1 | 2 | 3 | 4 | 5 | 11. | <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr></table> | 1 | 2 | 3 | 4 | 5 | 12. | <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr></table> | 1 | 2 | 3 | 4 | 5 |
| 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | | | | | | |
| 13. | <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr></table> | 1 | 2 | 3 | 4 | 5 | 14. | <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr></table> | 1 | 2 | 3 | 4 | 5 | 15. | <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr></table> | 1 | 2 | 3 | 4 | 5 |
| 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | | | | | | |
| 16. | <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr></table> | 1 | 2 | 3 | 4 | 5 | 17. | <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr></table> | 1 | 2 | 3 | 4 | 5 | 18. | <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr></table> | 1 | 2 | 3 | 4 | 5 |
| 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | | | | | | |
| 19. | <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr></table> | 1 | 2 | 3 | 4 | 5 | 20. | <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr></table> | 1 | 2 | 3 | 4 | 5 | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | | | | | | |

Part B- Structured Essay (40 Marks)

Answer all questions only in the space provided. Attached sheets will not be graded.

1. (a) ${}^{40}_{19}K$ undergoes radioactive decay in three ways:

- (i) 98.2% is by electron capture
- (ii) 1.35% is by β^- emission,
- (iii) 49% is by positron (β^+) emission

Write the nuclear equations for the three modes by which ${}^{40}_{19}K$ decays:

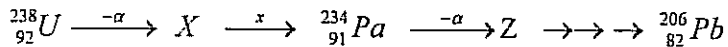
(i)

(ii)

(iii)

(06 marks)

(b) Consider the following part of a decay series:

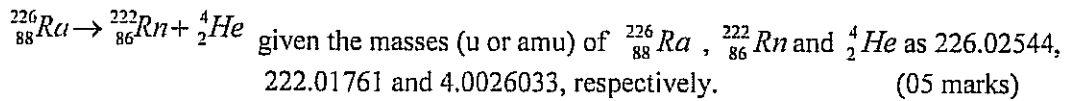


(i) Identify the type of decay series.

(ii) Identify X; Z.....; x (04 marks)

(c) Calculate the activity of 1 μ g of pure carbon-14 in Becquerel (Bq). Half- life of carbon-14 is 5730 years. (05 marks)

(d) Calculate the decay energy (MeV) for the radioactive decay process:

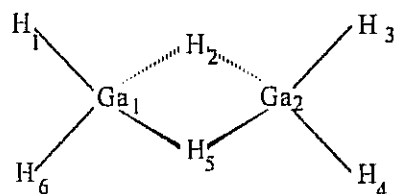


2. (a) XeF_5^- ion has a C_5 as its principal axis, It also has five C_2 axes.

i) Briefly describe the geometry of the nuclear skeleton of XeF_5^- .

ii) Sketch the nuclear skeleton of XeF_5^- and draw the five C_2 axes on it.

(b) Ga_2H_6 has the following structure.



Two Ga nuclei and the H_2 and H_5 are on a plane which is perpendicular the plane containing the remaining hydrogen nuclei and the two Ga nuclei.

i) Locate all the symmetry planes in Ga_2H_6 .

ii) Sketch the resultant configuration when a C_2 operation is performed on configuration of Ga_2H_6 shown in the above diagram, about the axis passing through the two Ga nuclei.

iii) Is the rotation operation described in part (ii) above a symmetry operation of Ga_2H_6 ? Briefly explain your answer.

iv) Locate all the remaining C_2 axes in Ga_2H_6 .

v) What is the principal axis of Ga_2H_6 ?

vi) Locate all the vertical planes in the molecule.

vii) Locate the horizontal plane in the molecule.

(20 marks)

Name :

Registration No:

Address:

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The Open University of Sri Lanka
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CMU2122 - Inorganic Chemistry - Level 4
Assignment Test - II Answer Guide

Part A – MCQ ANSWERS

1. (3) 2. (4) 3. (3) 4. (2) 5. (2) 6. (5) 7. (1) 8. (3) 9. (3) 10. (2)
 11. (2) 12. (3) 13. (5) 14. (3) 15. (1) 16. (2) 17. (4) 18. (4) 19. (2) 20. (1)

Part B

1. (a) (i) ${}_{19}^{40}\text{K} + {}_{-1}^0\text{e} \rightarrow {}_{18}^{40}\text{Ar}$
 (ii) ${}_{19}^{40}\text{K} \rightarrow {}_{-1}^0\beta + {}_{20}^{40}\text{Ca}$
 (iii) ${}_{19}^{40}\text{K} \rightarrow {}_{+1}^0\beta + {}_{18}^{40}\text{Ar}$

(b) (i) $(4n+2)$ series

(ii) $X = {}_{90}^{234}\text{X}$, $Z = {}_{89}^{230}\text{Z}$, $x = {}_{-1}^0\beta$

(c) Activity $A = N\lambda$

$$N = (1 \times 10^{-6} \text{ g} / 14 \text{ g mol}^{-1}) 6.023 \times 10^{23} \text{ mol}^{-1}$$

$$\lambda = 0.693 / t_{1/2} = 0.693 / (5730 \times 365 \times 24 \times 60 \times 60) \text{ s}$$

$$A = [0.693 / (5730 \times 365 \times 24 \times 60 \times 60) \text{ s}] (1 \times 10^{-6} / 14) (6.023 \times 10^{23} \text{ s}^{-1})$$

$$A = 1.65 \times 10^5 \text{ Bq}$$

(d) Mass loss, $\Delta m = 226.02544 - (222.01761 + 4.0026033)$

$$= 0.00523 \text{ u}$$

$$E = mc^2$$

$$= 0.00523 \times 1.661 \times 10^{-27} \text{ kg} \times (3 \times 10^8 \text{ ms}^{-1})^2$$

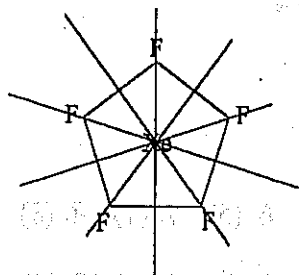
$$= 7.82 \times 10^{-13} \text{ J}$$

Decay energy, $E = 4.88 \text{ MeV}$

2. (a) (i) It has planar geometry.

The five F nuclei are on a regular pentagon.

(ii)

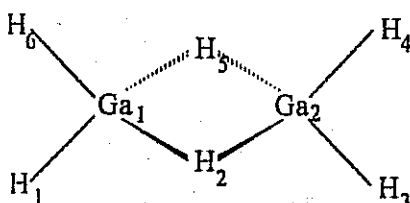


- (b) (i) Plane of two Ga nuclei and the H_2 and H_5 .

Plane of H_1, H_3, H_4 and H_6 (and then two Ga nuclei).

The plane perpendicular to the plane of two Ga nuclei and the H_2 and H_5 and passing through H_2 and H_5 .

(ii)



- (iii) The configuration drawn in part (ii) is equivalent to the original configuration.

It is a symmetry operation.

- (iv) The axis passing through H_2 and H_5

The axis perpendicular to the plane of two Ga nuclei and the H_2 and H_5 and passes through the mid point of the line joining the two Ga nuclei.

- (v) The axis passing through H_2 and H_5 or

The line passing through the two Ga nuclei

- (vi) Plane of two Ga nuclei, and the H_2 and H_5 .

The plane perpendicular to the plane of two Ga nuclei and the H_2 and H_5 and passing through H_2 and H_5 .

- (vii) Plane of H_1, H_3, H_4 and H_6 (and then two Ga nuclei).

If the principal axis chosen to be the line passing through the two Ga nuclei,

The plane perpendicular to the plane of two Ga nuclei and the H_2 and H_5 and passing through H_2 and H_5 .