THE OPEN UNIVERSITY OF SRI LANKA
B.Sc/B.Ed DEGREE PROGRAMME - 2013/2014
Level 4 - CMU2122/CME4122
INORGANIC CHEMISTRY
ASSIGNMENT TEST II (NBT)

11th April 2014 (Friday) 10.30 – 11.30 a.m.

Avogadro constant, L	$= 6.023 \times 10^{23}$ mol^{-1}
Planck's constant, h	$= 6.63 \times 10^{-34}$ J s
Velocity of light, c	$= 3 \times 10^{8}$ m s^{-1}
Mass of an electron	= 0.0005 a.m.u
Mass of a proton	= 1.0073 a.m.u.
Mass of a neutron	= 1.0089 a.m.u.
1 a.m.u.	$= 1.661 \times 10^{-27}$ kg
1 MeV	$= 1.6021 \times 10^{-13}$ J

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

1. For a part of the decay series given below, which of the following statements are true?

$$^{235}_{92}U \xrightarrow{-\alpha} X \xrightarrow{-x} {}^{231}_{91}Pa \xrightarrow{-\alpha} Y \xrightarrow{-\beta^-} {}^{227}_{90}Th \longrightarrow \longrightarrow \longrightarrow {}^{207}_{82}Pb$$

(a) It is the (4n+1) decay series (b) X is $^{231}_{90}Th$ (c) Y is $^{227}_{89}Ac$ (d) x is β^+

The answer is
1) (a) and (b) only 2) (b) and (c) only 3) (c) and (d) only
4) (a) and (d) only 5) (a), (b) and (c) only

2. One gram of carbon in living tissue has a constant β ray activity of 15.3 disintegrations per minute (dpm). If a piece of charcoal from a prehistoric site is found to emit 1.53 β particles per minute per gram of carbon, the age in years of the composite is ($t_{1/2}$ of *carbon-14* is 5730 y).

1) 1,904 2) 3,808 3) 9,521 4) 19,042 5) 38,084

3. The activity of 1 mg of pure *radium- 226* ($t_{1/2}$= 1600 y) in Becquerel (Bq) is

1) 3.7×10^{10} 2) 3.7×10^{4} 3) 3.7×10^{7} 4) 3.7×10^{12} 5) 3.7×10^{3}

4. Two of the following nuclides will be expected to be unstable and radioactive.

(a) $^{11}_{6}C$ (b) $^{18}_{9}F$ (c) $^{16}_{8}O$ (d) $^{12}_{6}C$

The answer is
1) (a) and (b) only 2) (b) and (c) only 3) (c) and (d) only
4) (a) and (d) only 5) (a), (b) and (c) only

5. What is/are the mode(s) of decay that ${}^{18}_{9}F$ may undergo?

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

The answer is

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

6. What will be the product formed when ${}^{22}_{9}F$ undergoes β^- decay?

1) ${}^{21}_{9}F$ 2) ${}^{22}_{8}O$ 3) ${}^{22}_{9}F$ 4) ${}^{21}_{8}O$ 5) ${}^{22}_{10}Ne$

7. Identify X in the nuclear reaction given by the notation, $X(n, p)^{35}_{16}S$

1) ${}^{36}_{17}Cl$ 2) ${}^{36}_{16}S$ 3) ${}^{35}_{17}Cl$ 4) ${}^{37}_{17}Cl$ 5) ${}^{34}_{16}S$

8. Identify the type of nuclear reaction:

${}^{11}_{6}C \rightarrow {}^{11}_{5}B + ?$

1) α- decay 2) electron emission 3) positron emission
4) electron capture 5) γ emission

Questions 9-10 are based on the nuclear reaction, ${}^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{140}_{54}Xe + {}^{94}_{38}Sr + x\ {}^{1}_{0}n$

9. The value of x is

1) 1 2) 2 3) 3 4) 4 5) 5

10. Which of the following statements is/are accurate description(s) of this nuclear reaction?

(a) It is called neutron emission (b) It is a nuclear fission
(c) It is a chain reaction (d) It is called neutron bombardment

The answer is

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

11. How does ${}^{40}_{19}K$ decay to ${}^{40}_{20}Ca$?

1) By positron emission 2) By electron capture 3) By electron emission
4) By neutron emission 5) By α-decay

12. Another mode of decay by ${}^{40}_{19}K$ is by positron emission. What will be the product of such a decay process?

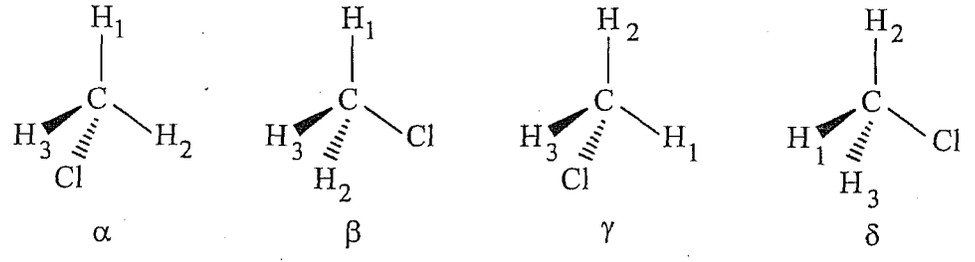
1) ${}^{40}_{19}K$ 2) ${}^{41}_{19}K$ 3) ${}^{40}_{20}Ca$ 4) ${}^{41}_{20}Ca$ 5) ${}^{40}_{18}Ar$

13. The energy released (MeV) in the nuclear fusion, ${}^{3}_{1}H + {}^{2}_{1}H \rightarrow {}^{1}_{0}n + {}^{4}_{2}He$ is

Given: masses (amu/u) of ${}^{3}_{1}H$, ${}^{2}_{1}H$ and ${}^{4}_{2}He$ are 3.0160492, 2.0141017 and 4.0026033 Respectively.

1) 17.6 2) 176 3) 8.8 4) 88 5) 18.8

Use the following figure, which shows four possible configurations, α, β, γ and δ, of a CH_3Cl molecule, in answering the questions 14, 15, 16 and 17.



α β γ δ

14. Consider the following four statements about the configurations shown in the figure above.

(i) Configurations α and β are equivalent.
(ii) Configurations α and γ are equivalent.
(iii) Configurations β and δ are equivalent.
(iv) Configurations γ and δ are equivalent.

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

1) Only (i) and (ii). 2) Only (i) and (iii). 3) Only (ii) and (iii).
4) Only (i) and (iv) 5) All (i), (ii), (iii) and (iv)

15. Consider the following statements about the configurations shown in the figure above.

(i) Configuration β can be obtained by a reflection operation performed on the configuration α which is <u>not</u> a symmetry operation of the molecule.
(ii) Configuration γ can be obtained by a reflection operation performed on the configuration α which is a symmetry operation of the molecule.
(iii) Configuration δ can be obtained by a rotation operation performed on the configuration γ which is <u>not</u> a symmetry operation of the molecule.

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

1) Only (i) and (ii). 2) Only (i) and (iii). 3) Only (ii) and (iii).
4) All (i), (ii) and (iii). 5) None of the <u>answers</u>, 1), 2), 3) or 4) is correct.

16. Consider the following statements about the configurations shown in the figure above.

(i) Rotation of the molecule in configuration α by 360° about an axis passing through <u>any</u> of the three CH bonds is an identity operation.
(ii) Rotation of the molecule in configuration β by 360° about the axis passing through CCl bond is an identity operation.
(iii) Reflection of the molecule in configuration γ <u>once</u> through the plane passing through the CCl bond and any H nucleus is an identity operation.

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

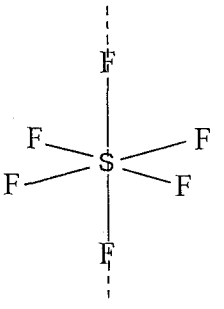
1) Only (i) and (ii). 2) Only (i) and (iii). 3) Only (ii) and (iii).
4) All (i), (ii) and (iii). 5) None of the <u>answers</u>, 1), 2), 3) or 4) is correct.

17. Consider the following statements about the configurations shown in the figure above.

(i) The axis passing through the CCl bond in configuration α is a rotational axis of symmetry of the molecule.
(ii) The axis passing through any of the CH bonds in configuration β is a rotational axis of symmetry of the molecule.
(iii) The axis passing through the CCl bond in configuration δ is a rotational axis of symmetry of the molecule of order 3.

The correct statements, out of (i), (ii) and (iii) above, are
1) Only (i) and (ii). 2) Only (i) and (iii). 3) Only (ii) and (iii).
4) All (i), (ii) and (iii). 5) None of the answers, 1), 2), 3) or 4) is correct.

18. In standard notation, which of the following represent the total set of distinct symmetry operations that can be performed about the axis passing through the S nucleus and two F nuclei in SF_6 shown in the figure to the right by a dashed line.

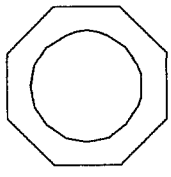


1) $\{E, C_6, C_6^2, C_6^3, C_6^4, C_6^5\}$ 2) $\{E, C_4, C_4^7, C_4^5\}$

3) $\{E, C_4, C_4^7, C_4^8\}$ 4) $\{E, C_6, C^3, C_6^4, C_6^{11}, C_6^8\}$

5) $\{E, C_4, C_4^3, C_4^6\}$

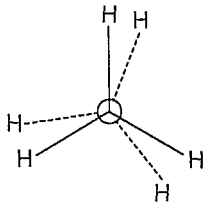
19. Consider the following statements about the aromatic planar molecule, C_8H_8, shown in the figure to the right.



(i) It has 8 (eight) C_2 axes on the plane of the molecule.
(ii) The principal axis is perpendicular to the plane of the molecule and is of order 4 (four).
(iii) The plane of the molecule is a horizontal plane of symmetry (σ_h).

The correct statements, out of (i), (ii) and (iii) above, are
1) Only (i) and (ii). 2) Only (i) and (iii). 3) Only (ii) and (iii).
4) All (i), (ii) and (iii). 5) None of the answers, 1), 2), 3) or 4) is correct.

20. Consider the following statements about ethane in neither staggered nor eclipsed conformation, the Newmann projection formula of which is shown in the figure to the right.



(i) C–C bond axis is a symmetry axis of rotation of order 3.
(ii) It has no planes of symmetry.
(iii) C–C bond axis is the principal axis of the molecule in this configuration.

The correct statements, out of (i), (ii) and (iii) above, are
1) Only (i) and (ii). 2) Only (i) and (iii). 3) Only (ii) and (iii).
4) All (i), (ii) and (iii). 5) None of the answers, 1), 2), 3) or 4) is correct.

21. Consider the following statements.

(i) A molecule cannot have another axis of rotation which has the same order as that of its principal axis.

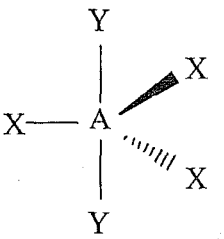
(ii) A molecule cannot have another axis of rotation which has an order higher than that of its principal axis.

(iii) A molecule of benzene has only one principal axis.

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

1) Only (i) and (ii). 2) Only (i) and (iii). 3) Only (ii) and (iii).
4) All (i), (ii) and (iii). 5) None of the answers, 1), 2), 3) or 4) is correct.

22. Consider the molecule, AX_3Y_2, which has a trigonal bipyramidal structure as shown in the figure to the right. Consider the following statements.



(i) YAY axis is the principal axis of symmetry of the molecule.

(ii) The plane passing through YAY and any X nucleus is a dihedral plane.

(iii) The molecule has a centre of inversion.

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

1) Only (i) and (ii). 2) Only (i) and (iii). 3) Only (ii) and (iii).
4) All (i), (ii) and (iii). 5) None of the answers, 1), 2), 3) or 4) is correct.

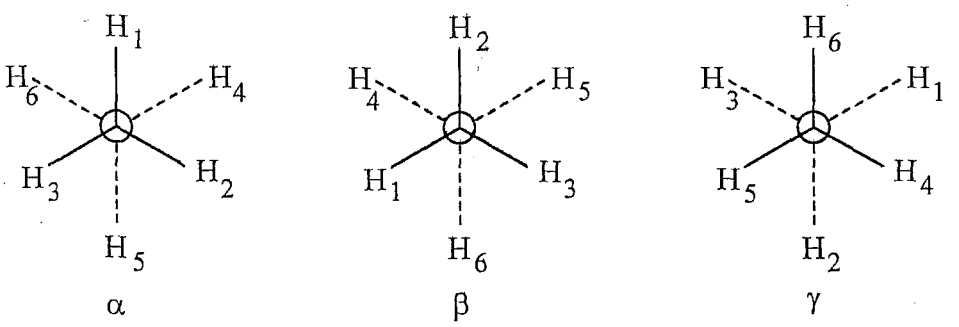
23. Which of the following molecules have a centre of inversion?

(i) C_2H_2 (ii) Ethane in eclipsed configuration (iii) *cis*-$CHCl = CHCl$

(iv) *trans*-$CHCl = CHCl$

1) Only (i) and (ii). 2) Only (i) and (iii). 3) Only (ii) and (iv).
4) Only (i), (ii) and (iv). 5) Only (i) and (iv).

24. Following figure shows 3 configurations, α, β and γ, of staggered ethane.



Consider the following statements about the above configurations.

(i) S_6^{10} operation about the C-C bind axis performed on configuration α gives configuration β.

(ii) S_6^2 operation about the C-C bind axis performed on configuration α gives configuration γ.

(iii) S_6^3 operation about the C-C bind axis performed on configuration γ gives configuration β.

The correct statements, out of (i), (ii) and (iii) above, are
1) Only (i) and (ii). 2) Only (i) and (iii). 3) Only (ii) and (ii
4) All (i), (ii) and (iii). 5) None of the answers, 1), 2), 3) or 4) is correct.

25. Consider the following statements.
(i) *Always* there are *only* 5 distinct symmetry operations about an S_5 axis.
(ii) *Always* there is a C_5 coincident with an S_5 axis.
(iii) *Always* there is a symmetry plane perpendicular to an S_5 axis.

The correct statements, out of (i), (ii) and (iii) above, are
1) Only (i) and (ii). 2) Only (i) and (iii). 3) Only (ii) and (iii).
4) All (i), (ii) and (iii). 5) None of the answers, 1), 2), 3) or 4) is correct.

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CMU2122/CME4122 – INORGANIC CHEMISTRY- LEVEL 4
ASSIGNMENT TEST-II

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

	Marks
Total (%)	

Reg. No. | | For Examiners Use

		Marks
Correct Answers		
Wrong Answers		
Total		

01.	1	2	3	4	5	02.	1	2	3	4	5	03.	1	2	3	4	5
04.	1	2	3	4	5	05.	1	2	3	4	5	06.	1	2	3	4	5
07.	1	2	3	4	5	08.	1	2	3	4	5	09.	1	2	3	4	5
10.	1	2	3	4	5	11.	1	2	3	4	5	12.	1	2	3	4	5
13.	1	2	3	4	5	14.	1	2	3	4	5	15.	1	2	3	4	5
16.	1	2	3	4	5	17.	1	2	3	4	5	18.	1	2	3	4	5
19.	1	2	3	4	5	20.	1	2	3	4	5	21.	1	2	3	4	5
22.	1	2	3	4	5	23.	1	2	3	4	5	24.	1	2	3	4	5
25.	1	2	3	4	5												

Answer Guide for CAT-II-2013/2014
CMU2122/CME4122 – Inorganic Chemistry held on 11-04-2014

MCQ ANSWERS

1. (2)	**2.** (4)	**3.** (3)	**4.** (1)	**5.** (5)
6. (5)	**7.** (3)	**8.** (3)	**9.** (2)	**10.** (2)
11. (3)	**12.** (5)	**13.** (1)	**14.** (3)	**15.** (4)
16. (1)	**17.** (2)	**18.** (5)	**19.** (2)	**20.** (4)
21. (3)	**22.** (1)	**23.** (5)	**24.** (2)	**25.** (3)