(11)

843

**THE OPEN UNIVERSITY OF SRI LANKA**
**B. Sc DEGREE PROGRAMME 2017/2018**
**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

| | | |
|---|---|---|
| Correct Answers | | |
| Wrong & Unanswered | | |
| Total | 25 | |

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

25. 1 2 3 4 5

***
***

**Registration Number:** ----------

**Name:** ----------

**Address** ----------

---

---

---

**THE OPEN UNIVERSITY OF SRI LANKA**
**B.Sc/B.Ed DEGREE PROGRAMME – 2017/2018**
**Level 4 – CYU4300**
**INORGANIC CHEMISTRY**
**ASSIGNMENT TEST II (NBT)**

---

17th July 2018 4.15 p.m to 5.15 p.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 |

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

**Mobile phones and any other electronic equipment** are strictly prohibited; leave them outside.

Write your **registration number and address** in the space provided for this purpose

1. Consider a part of the decay series given below.

$$^{234}_{91}Pa \xrightarrow{-\beta^-} Y \xrightarrow{-y} {}^{230}_{90}Th \rightarrow \rightarrow \rightarrow {}^{210}_{84}Po \xrightarrow{z} {}^{206}_{82}Pb$$

Which of the following statements are true?

(i) It is (4n+2) decay series (ii) $Y$ is $^{234}_{90}Th$ (iii) y is $\beta^-$ (iv) z is $\alpha$

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

2. How does $^{232}_{90}Th$ decay to $^{228}_{88}Ra$ ?

(1) By positron emission (2) By electron capture (3) By electron emission

(4) By neutron emission (5) By α-decay

3. The half-life ($t_{1/2}$) of carbon-11 is 20.4 min. What percentage of the original 1.0 μg sample of carbon-11 is left after a 1 hour 21.6 min period?

(1) 37.5 (2) 25 (3) 17.5 (4) 12.5 (5) 6.25

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

(1) $3.66 \times 10^7$ (2) $2.26 \times 10^4$ (3) $3.66 \times 10^4$ (4) $1.83 \times 10^4$ (5) $1.13 \times 10^4$

5. Which of the following nuclides will be expected to be unstable and radioactive?

(1) ${}^{4}_{2}He$ (2) ${}^{12}_{6}C$ (3) ${}^{16}_{8}O$ (4) ${}^{18}_{9}F$ (5) ${}^{20}_{10}Ne$

6. What is/are the mode/s of decay that ${}^{11}_{6}C$ may undergo?

(i) electron emission (ii) positron emission (iii) electron capture (iv) $\gamma$ emission

The answer is

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

7. What will be the product formed when ${}^{40}_{19}K$ undergoes electron capture?

(1) ${}^{40}_{20}Ca$ (2) ${}^{41}_{19}K$ (3) ${}^{39}_{19}K$ (4) ${}^{40}_{18}Ar$ (5) ${}^{41}_{18}Ar$

8. What is the mode of decay that ${}^{22}_{9}F$ is likely to undergo?

(1) electron emission (2) positron emission (3) electron capture
(4) $\alpha$ decay (5) $\gamma$ emission

9. Identify $x$ in the nuclear reaction given by the notation, ${}^{14}_{7}N(x, p){}^{14}_{6}C$:

(1) $\alpha$ (2) $n$ (3) $\beta^-$ (4) $\beta^+$ (5) $\gamma$

10. ${}^{235}_{92}U + {}^{1}_{0}n \rightarrow [{}^{236}_{92}U^*] \rightarrow {}^{144}_{56}Ba + {}^{90}_{36}Kr + 2{}^{1}_{0}n$

Which of the following is/are true about the nuclear reaction given above?

(i) It is a fission (ii) It is a chain reaction (iii) ${}^{236}_{92}U^*$ is a compound nucleus
(iv) It is a neutron capture

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

11. At 12.00 noon, in a nuclear pharmacy, the activity of ${}^{111}In$ was found to be 10 mCi. Calculate the activity of ${}^{111}In$ in mCi at 1.30 p.m. the same day. The half life ($t_{1/2}$) of ${}^{111}In$ is 2.83 days.

(1) 8.469 (2) 6.984 (3) 9.846 (4) 8.964 (5) 4.986

12. The nuclear reaction, ${}^{2}_{1}H + {}^{1}_{1}H \rightarrow {}^{3}_{2}He$ is a

(1) nuclear fission (2) nuclear fusion (3) $\alpha$ emission

(4) proton capture (5) deuterium decay

13. In an isotope dilution analysis to determine glycine in a mixture, 5 mg of *carbon-14* labelled glycine (specific activity= 1800 counts $min^{-1}$ $mg^{-1}$) was added to the mixture. After equilibration, 1 mg of pure glycine isolated gave a specific activity of 150 counts $min^{-1}$ $mg^{-1}$.
The amount of glycine (in mg) in the mixture is

(1) 90 (2) 75 (3) 60 (4) 55 (5) 50

14. An identical configuration of a molecule is
(i) an electronic configuration where similar electrons occupy slightly different positions in space.
(ii) an equivalent configuration of the molecule.
(iii) a nuclear configuration where identical nuclei occupy identical positions in space.

The correct statement/s, out of (i), (ii) and (iii) above, is/are
(1) (ii) only. (2) (iii) only. (3) (i) and (ii) only.
(4) (i), and (iii) only (5) (ii) and (iii) only

15. A symmetry operation always carries
(i) one electronic configuration of a molecule to a different electronic configuration of the same molecule.
(ii) the nuclei of a molecule from one configuration to an identical configuration.
(iii) the nuclei of a molecule from one configuration to an equivalent configuration.

The correct statement/s, out of (i), (ii) and (iii) above, is/are
(1) (i) only. (2) (ii) only. (3) (iii) only.
(4) (i), and (iii) only (5) (ii) and (iii) only

16. Consider the following statements about symmetry elements of a molecule.
(i) Every molecule possesses at least one symmetry element.
(ii) It is a geometric entity.
(iii) Some symmetry elements do <u>not</u> have symmetry operations associated with them.

The correct statement/s, out of (i), (ii) and (iii) above, is/are
(1) (i) only. (2) (ii) only. (3) (iii) only.
(4) (i), and (iii) only (5) (ii) and (iii) only

17. Consider the following statements about symmetry planes of a molecule.
(i) The maximum number of distinct reflection symmetry operations about a particular symmetry plane of a molecule can be <u>three</u>.
(ii) The maximum number of distinct reflection symmetry operations about a particular symmetry plane of a molecule can be <u>one</u>.
(iii) Some molecules may <u>not</u> have symmetry planes.

The correct statement/s, out of (i), (ii) and (iii) above, is/are

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

18. Consider the following statements about rotational axes of a molecule.
    (i) The rotational axis of a molecule that has the highest order is called the principal axis of that molecule.
    (ii) The order of the principal axis of an ammonia molecule is <u>three</u>.
    (iii) Any molecule has at least one rotational axis of order greater than one.

    The correct statement/s, out of (i), (ii) and (iii) above, is/are

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

19. Consider the following statements about the symmetry elements of a benzene molecule.
    (i) Principal axis is $C_6$.
    (ii) It has <u>six</u> $C_2$ axes.
    (iii) The plane of the molecule is a $\sigma_h$.

    The correct statement/s, out of (i), (ii) and (iii) above, is/are

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

20. What is the <u>*correct*</u> relationship regarding a reflection operation about the horizontal plane in $PtCl_4^{2-}$ ion?

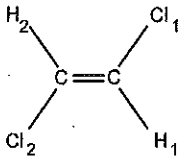
    (1) $\sigma = E$ (2) $\sigma = \sigma^2$ (3) $\sigma^2 = \sigma^3$ (4) $\sigma^2 = E$ (5) $\sigma^3 = E$

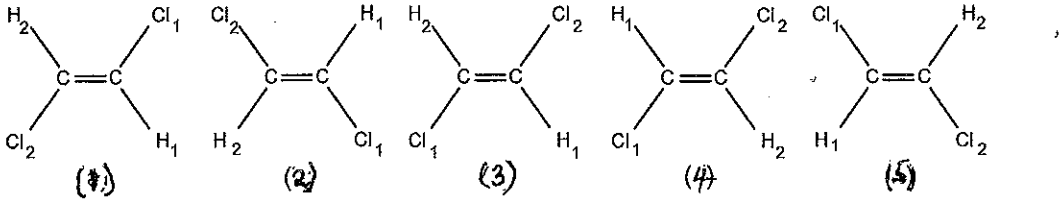
21. A student prepared an exotic linear molecule with molecular formula $A_2B_3$. Its structure is $A - B = B = B - A$. The A-B bond length is x and the B=B bond length is y. The student observed that $x \neq y$. Consider the following statements about the symmetry elements of this molecule.
    (i) Principal axis is $C_\infty$.
    (ii) The molecule has only <u>two</u> $C_2$ axes.
    (iii) The molecule has an inversion centre.

    The correct statement/s, out of (i), (ii) and (iii) above, is/are

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

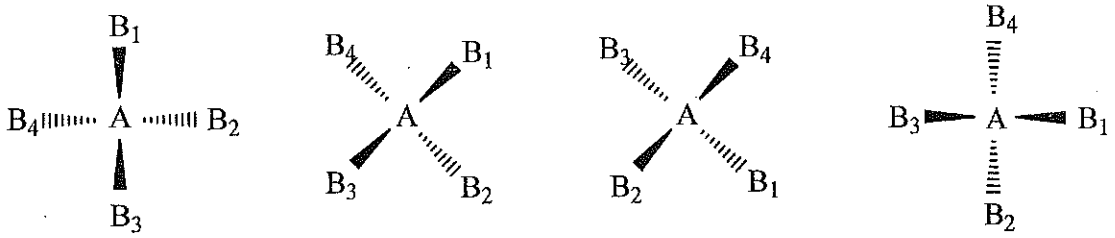
22. Pick the outcome of the symmetry operation $i^3$ on the following nuclear configuration of trans-CHCl=CHCl.




**Use the following four configurations of a tetrahedral molecule $AB_4$ in answering questions 23, 24 and 25.**

As usual, the AB bonds indicated by the black triangles are above the plane of the paper. The other two bonds are below the paper. In all configurations the axis that is on the BAB plane which is above the paper and bisects that BAB angle, is perpendicular to the paper. This axis is denoted by $\alpha$.




23. Consider the following statements.
    (i) Configuration (a) can be taken to configuration (b) by rotating the molecule by $45^0$ about the axis $\alpha$.
    (ii) Configuration (a) can be taken to configuration (d) using the identity operation.
    (iii) The operation that takes configuration (b) to configuration (c) is a symmetry operation of the molecule.
    (iv) Rotation of the molecule by $180^0$ about the axis $\alpha$ is a symmetry operation of $AB_4$.

    The correct statements, out of (i), (ii), (iii) and (iv) above, are
    (1) Only (i) and (ii). (2) Only (i), (ii) and (iii). (3) Only (ii) and (iii).
    (4) Only (i) (iii) and (iv) (5) All (i), (ii), (iii) and (iv)

24. Consider the following statements.

(i) The axis $\alpha$ is a $C_4$ axis of the molecule.

(ii) The axis $\alpha$ is a $S_4$ axis of the molecule.

(iii) One can take configuration (a) to configuration (d) using a composite operation of a reflection through a plane and a rotation about the axis $\alpha$.

(iv) One can take configuration (b) to configuration (c) using a composite operation of a reflection through a plane and a rotation about an axis.

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

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

25. In standard notation, which of the following represents the total set of distinct rotational symmetry operations that can be performed about the axis $\alpha$.

(1) $\left\{E, C_4, C_4^3, C_4^5\right\}$ (2) $\left\{E, C_4^5, C_4^8, C_4^{13}\right\}$ (3) $\left\{E, C_4, C_4^6, C_4^{11}\right\}$

(4) $\left\{E, C_2^3\right\}$ (5) $\left\{E, C_2^3, C_2^5\right\}$

**The Open University of Sri Lanka**
**B.Sc. Degree Program 2017/2018**
**CYU 4300 – Inorganic Chemistry – Level 4**
**Assignment Test – II – Answer Guide**

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