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THE OPEN UNIVERSITY OF SRI LANKA
B.Sc. DEGREE PROGRAMME - 2019/2020
LEVEL 4 - CYU4300
INORGANIC CHEMISTRY
ASSIGNMENT TEST II (NBT)

DATE: 3rd September 2019 4.15 p.m. – 5.15 p.m.

Avogadro constant, L	$= 6.023 \times 10^{23}$ mol^{-1}
Velocity of light, c	$= 3 \times 10^{8}$ m s^{-1}
1 a.m.u.	$= 1.661 \times 10^{-27}$ kg
1 MeV	$= 1.6021 \times 10^{-13}$ J

Answer all questions

Mark a cross ***X*** over (**English letter**) that corresponds to the most suitable answer on the **given answer sheet**. Any answer with more than one ***X*** will not be counted.

1. Consider a part of the decay series given below. Which of the following statements are true?

$$^{238}_{92}U \xrightarrow{-\alpha} X \xrightarrow{-x} {}^{234}_{91}Pa \xrightarrow{-\beta^-} Y \longrightarrow\longrightarrow {}^{206}_{82}Pb$$

(i) It is (4n+2) decay series (ii) X is $^{234}_{90}Th$ (iii) x is β^- (iv) Y is $^{233}_{90}Th$

The **answer** is

a) (i) and (ii) only b) (ii) and (iii) only c) (iii) and (iv) only
d) (i) and (iv) only e) (i), (ii) and (iii) only

2. How does $^{218}_{84}Po$ decay to $^{218}_{85}At$?

a) By positron emission b) By electron capture c) By electron emission
d) By neutron emission e) By α-decay

3. At 12.00 noon, in a nuclear pharmacy, the activity of the radioactive indium-111 was found to be 10 mCi. What will be the activity of indium-111 in mCi at 13.30 hrs the same day? The half- life ($t_{1/2}$) of indium-111 is 2.83 days.

a) 8.50 b) 8.75 c) 8.95 d) 9.85 e) 9.95

4. The activity of 1 μg of pure *indium-111* ($t_{1/2}$= 2.83 day) in Becquerel (Bq) is

a) 1.54×10^{10} b) 1.54×10^{7} c) 1.54×10^{4} d) 1.32×10^{7} e) 1.32×10^{4}

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

(a) $^{4}_{2}He$ (b) $^{11}_{6}C$ (c) $^{16}_{8}O$ (d) $^{20}_{10}Ne$ (e) $^{40}_{20}Ca$

6. What are the modes of decay that $^{13}_{7}N$ may undergo?

(i) γ emission (ii) electron emission
(iii) positron emission (iv) electron capture

The **answer** is

a) (i) and (ii) only b) (ii) and (iii) only c) (iii) and (iv) only
d) (i) and (iv) only e) (i), (ii) and (iii) only

7. What will be the product formed when ${}^{15}_{8}O$ undergoes electron capture?

a) ${}^{15}_{9}F$ b) ${}^{16}_{9}F$ c) ${}^{16}_{8}O$ d) ${}^{14}_{7}N$ e) ${}^{15}_{7}N$

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

(a) electron capture (b) positron emission (c) electron emission
(d) α decay (e) γ emission

9. Identify x in the nuclear reaction given by the notation, ${}^{10}_{5}B(x,\alpha)^{7}_{3}Li$:

a) α b) n c) β^- d) β^+ e) γ

10. Which of the following is true about the following nuclear reaction?

${}^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{140}_{54}Xe + {}^{94}_{38}Sr + 2{}^{1}_{0}n$

(i) fission (ii) neutron capture (iii) neutron emission (iv) chain reaction

The **answer** is

a) (i) and (ii) only b) (ii) and (iii) only c) (iii) and (iv) only
d) (i) and (iv) only e) (i), (ii) and (iii) only

11. Which of the following statements is/are true about radiocarbon dating?

(i) The method is based on the production of *carbon-14* by irradiation of atmospheric nitrogen with neutrons
(ii) *Carbon-14* undergoes β^- decay
(iii) The materials suitable for radiocarbon dating are metals and glass
(iv) The error involved in the determination of age of a specimen is ±100 year

The **answer** is

a) (i) and (ii) only b) (ii) and (iii) only c) (iii) and (iv) only
d) (i) and (iv) only e) (i), (ii) and (iii) only

12. One gram of carbon in living tissue has a constant activity of 15.3 disintegrations per minute (dpm). If a piece of charcoal from a prehistoric site is found to show an activity of 3.85 dpm per gram of carbon, the age in years of the campsite is ($t_{1/2}$ of *carbon-14* is 5730 y).

a) 14,100 b) 13,800 c) 11,400 d) 10,800 e) 9,900

13. Given the masses (amu/u) of ${}^{3}_{1}H$, ${}^{2}_{1}H$, ${}^{4}_{2}He$ and neutron as 3.0160492, 2.0141017, 4.0026033 and 1.0086649 respectively, the energy released (MeV) in the nuclear fusion,

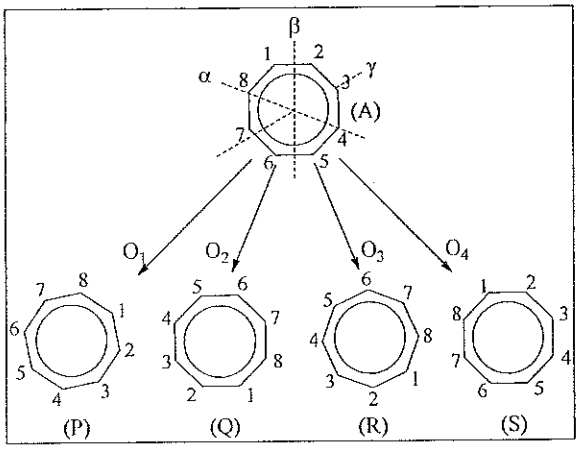
${}^{3}_{1}H + {}^{2}_{1}H \rightarrow {}^{1}_{0}n + {}^{4}_{2}He$ is

a) 176.0 b) 88.0 c) 18.8 d) 17.6 e) 8.8

Use the following information in answering questions 14–19.

A configuration of the planar aromatic ion, $C_8H_8^-$, (on the paper) is shown in figure (A). Axis α passes through two opposite C nuclei. Axis β passes through two opposite C-C bonds bisecting them. Axis γ passes through the centre of the ion and is perpendicular to the plane of the ion. Figures (P), (Q), (R) and (S) show the resultant configurations of $C_8H_8^-$ when operations, O_1, O_2, O_3 and O_4 are performed on

configuration (A). The carbon nuclei labels are also shown. [All the C-C bond lengths and all the C-C-C bond angles in $C_8H_8^-$ are equal.]



14. Consider the following statements.
    (i) Configurations (A) and (Q) are equivalent.
    (ii) Configurations (P) and (R) are identical.
    (iii) Configurations (Q) and (S) are equivalent.

    The correct statements, out of (i), (ii) and (iii) above are,
    (a) Only (i) and (ii). (b) Only (i) and (iii). (c) Only (ii) and (iii).
    (d) All (i), (ii), and (iii). (e) **None** of the **answers**, (a), (b) (c) or (d) is correct.

15. Consider the following statements.
    (i) Operation O_1 is a symmetry operation of $C_8H_8^-$.
    (ii) Operation O_2 is a symmetry operation of $C_8H_8^-$.
    (iii) Operation O_4 is the identity operation of $C_8H_8^-$.

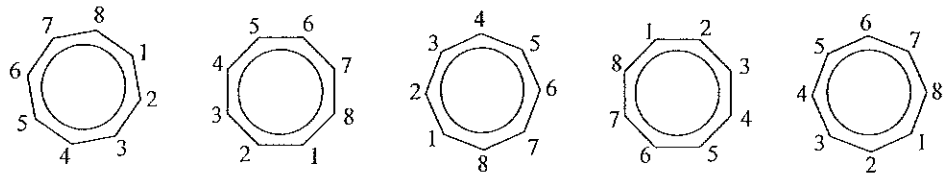
    The **correct** statement/s is/are,
    (a) Only (i) and (ii). (b) Only (i) and (iii). (c) Only (ii) and (iii)
    (d) All (i), (ii), and (iii). (e) Only (iii).

16. Consider the following statements.
    (i) Axis α is a symmetry element of $C_8H_8^-$.
    (ii) The compound operation of O_2 followed by operation O_4 is a symmetry operation of $C_8H_8^-$.
    (iii) Axis β is a symmetry element of $C_8H_8^-$.

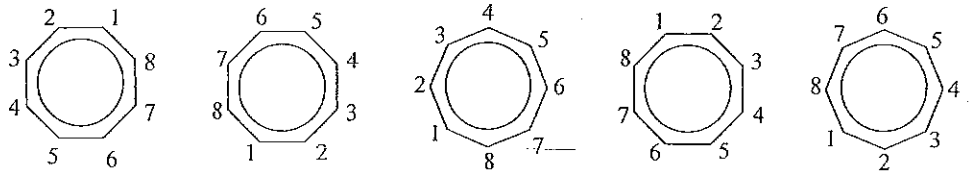
    The **correct** statement/s is/are,
    (a) Only (i) and (ii). (b) Only (i) and (iii). (c) Only (ii) and (iii).
    (d) All (i), (ii), and (iii). (e) Only (ii).

17. Which of the following best represents the order of the rotational symmetry axis, γ, of $C_8H_8^-$?
    (a) 4 (b) 5 (c) 6 (d) 7 (e) 8

18. Which of the following best represents resultant configuration when operation O_4 is performed on configuration (R) of $C_8H_8^-$?

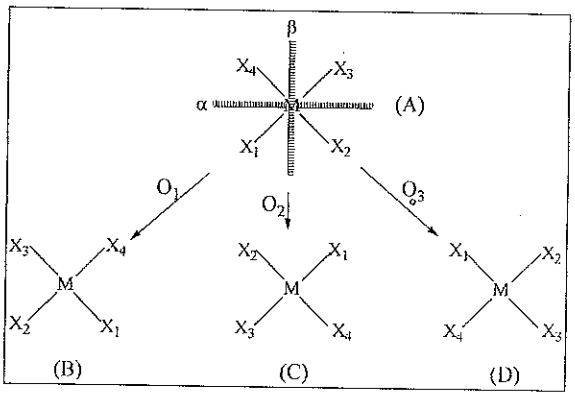


19. Which of the following best represents resultant configuration when configuration (A) is rotated by 180^0 about the axis β?



Use the following information in answering questions 20 and 21.

Figure (A) shows a configuration of a square planar complex ion, MX_4^{2-} (on the paper). α and β are two mirror planes which are perpendicular to each other and perpendicular to the plane of the paper. Each mirror plane bisects two XMX angels as shown in the figure. Figures (B), (C), and (D) represent the resultant configurations after performing the operations, O_1, O_2 and O_3, respectively.



20. Consider the following statements.

(i) All three operations, O_1, O_2 and O_3, are symmetry operations of MX_4^{2-}.

(ii) Operation O_1 can be a reflection operation through β.

(iii) Performance of operation O_3 on (B) gives (C).

The **correct** statement/s is/are,

(a) Only (i) and (ii). (b) Only (i) and (iii). (c) Only (ii) and (iii).
(d) All (i), (ii), and (iii). (e) Only (i).

21. Consider the following statements.

(i) Planes, α and β are symmetry elements of MX_4^{2-}.

(ii) You **cannot** transform configuration (C) to configuration (D) through a symmetry operation of MX_4^{2-}.

(iii) The plane of the ion is a symmetry element of MX_4^{2-}.

The **correct** statement/s is/are,

(a) Only (i) and (ii). (b) Only (i) and (iii). (c) Only (ii) and (iii).
(d) All, (i), (ii), and (iii). (e) Only (ii).

22. Consider the following statements about the symmetry elements of an ammonia molecule, NH_3.

(i) Its principal axis is C_3.

(ii) It has 3 vertical planes of symmetry.

(iii) It has 3 dihedral planes of symmetry.

The **correct** statement/s is/are,

(a) Only (i) and (ii). (b) Only (i) and (iii). (c) Only (ii) and (iii).
(d) All (i), (ii), and (iii). (e) **None** of the **answers**, (a), (b) (c) or (d) is correct.

23. A student suggested the following relationships (in standard notation) between reflection operations about any of the symmetry planes of a methane molecule, CH_4.

(i) $\sigma = E$ (ii) $\sigma^2 = E$ (iii) $\sigma = \sigma^3$ (iv) $\sigma^2 = \sigma^4$

The **correct** relationships are,

(a) Only (i) and (ii). (b) Only (iii) and (iv). (c) Only (i), (ii) and (iii).
(d) Only (ii), (iii) and (iv). (e) All (i), (ii), (iii) and (iv).

24. Consider the following statements about an inversion centre of a molecule.

(i) Some molecules may have more than one inversion centre.

(ii) If there is a single nucleus of one kind in a molecule, then the inversion centre, if exists, is located on that nucleus.

(iii) Nuclei that are **not** on the inversion centre appear in pairs, which exchange positions in the inversion operation.

The **correct** statements are,

(a) Only (i) and (ii). (b) Only (i) and (iii). (c) Only (ii) and (iii).
(d) All (i), (ii), and (iii). (e) **None** of the **answers**, (a), (b) (c) or (d) is correct.

25. Consider the following statements about the C-C bond axis of an ethane molecule in its *staggered* configuration.

(i) It is a C_3 axis.

(ii) Rotation of the molecule by an angle 480^0 about it, is a symmetry operation of the molecule.

(iii) It is an S_3 axis.

The **correct** statements are,

(a) Only (i) and (ii). (b) Only (i) and (iii). (c) Only (ii) and (iii).
(d) All (i), (ii), and (iii). (e) **None** of the **answers**, (a), (b) (c) or (d) is correct.

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B. Sc. Degree Programme - Level 4
CAT-II - 2019/2020

CYU4300 - Inorganic Chemistry

MCQ Answer Sheet: Mark a cross (×) over the **English Letter** that corresponds to the most suitable answer.

Reg. No. [ ]

FOR EXAMINER'S USE ONLY		
Answers	No.	Marks
Correct		
Wrong		
Total		

1	a	b	c	d	e	2	a	b	c	d	e	3	a	b	c	d	e	4	a	b	c	d	e
5	a	b	c	d	e	6	a	b	c	d	e	7	a	b	c	d	e	8	a	b	c	d	e
9	a	b	c	d	e	10	a	b	c	d	e	11	a	b	c	d	e	12	a	b	c	d	e
13	a	b	c	d	e	14	a	b	c	d	e	15	a	b	c	d	e	16	a	b	c	d	e
17	a	b	c	d	e	18	a	b	c	d	e	19	a	b	c	d	e	20	a	b	c	d	e
21	a	b	c	d	e	22	a	b	c	d	e	23	a	b	c	d	e	24	a	b	c	d	e
25	a	b	c	d	e																		

Answer Guide for CAT-II-2019/2020
CYU4300 – Inorganic Chemistry held on 03-09-2019

MCQ ANSWERS

1. e **2.** c **3.** d **4.** a **5.** b **6.** c **7.** e **8.** c **9.** b **10.** d

11. a **12.** c **13.** d **14.** b **15.** c **16.** d **17.** e **18.** e **19.** a **20.** d

21. b **22.** a **23.** d **24.** c **25.** a

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