

Sarajevo School of Science and Technology

Entrance Exam: **CHEMISTRY**

Name: _____

Show that one of the provided answers is the solution of the problem. Circle the correct answer.

1. A sample of N_2 gas occupies 4.48 L volume under standard conditions. What is the mass of the sample? The atomic mass of N is 14 amu.

A: 5.6 g
B: 56 g
C: 2.8 g
D: 28 g
E: 22.4 g

2. Which properties are characteristic for the nonmetals?

1) high electrical conductivity
2) large ionization energy
3) high electronegativity
4) low electronaffinity

A: 1,2 B: 2,3 C: 3,4 D: 2,4 E: 1,2,3

3. Concerning $1.2 \times 10^{24} CO_2$ molecules, which statements are true?

1) it is 12 moles.
2) it occupies 1.2×22.4 L volume under standard conditions.
3) it has a mass of 88 grams.
4) it consists of 3.6×10^{24} atoms.

A: 1,3 B: 1,4 C: 2,3 D: 2,4 E: 3,4

4. Which of the following molecules contain covalent bonds only?

1) $BaCl_2$
2) CCl_4
3) HCl
4) NH_4

A: 1,2,3,4 B: 1,2,4 C: 2,3 D: 1,3 E: 2,3,4

5. Which of the following atoms are isotopes?

- 1) **X**: 11 protons, 11 electrons, 12 neutrons
- 2) **Y**: 11 protons, 10 electrons, 12 neutrons
- 3) **V**: 11 protons, 11 electrons, 13 neutrons
- 4) **W**: 12 protons, 12 electrons, 12 neutrons

A: **X** and **Y** B: **X** and **W** C: **Y** and **V** D: **V** and **W** E: **X** and **V**

6. An aqueous solution is prepared by dissolving 1.6 g NaOH in 250 mL final volume. What is the molar concentration of the solution?

The molar mass of NaOH is 40 g/mol.

- A: 6.4 mol/L
 B: 1.6 mol/L
 C: 16 mol/L
 D: 0.16 mol/L
 E: 64 mol/L

7. $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \leftrightarrow 2\text{NH}_3(\text{g})$

The reaction is exothermic towards product formation. Which of the following changes of conditions will shift the equilibrium of the reaction to the right?

- 1) increase the pressure.
- 2) increase the concentration of NH_3 .
- 3) increase the concentration of H_2 gas.
- 4) decreasing the temperature.

A: 1,3,4 B: 2,3 C: 2,4 D: 2,3,4 E: 1,2,3,4

8. When two elements **X** (atomic number 13) and **Y** (atomic number 8) react the compound formed will be:

- A: XY
 B: X_3Y_2
 C: XY_2
 D: X_2Y
 E: X_2Y_3

9. Which is the most basic solution?

- A: pH=11
 B: pOH=12
 C: pOH=2
 D: $[\text{OH}^-]=10^{-4} \text{ mol/L}$
 E: $[\text{H}^+]=10^{-4} \text{ mol/L}$

10. Which of the following solutions contains the largest amount of dissolved glucose?

- A: 0.25 L of 5 M solution
- B: 0.5 L of 2 M solution
- C: 50 mL of 0.2 M solution
- D: 500 mL of 1 M solution
- E: 1000 mL of 0.5 M solution

11. In any reaction where a calcium atom changes to calcium ion, the calcium atom

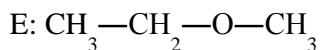
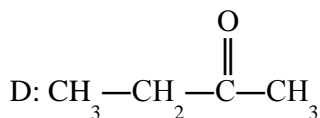
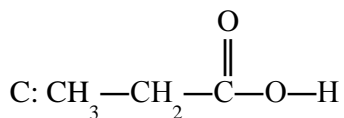
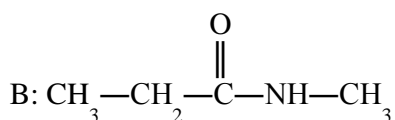
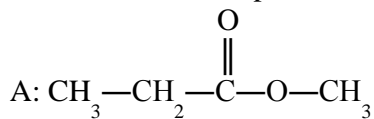
- 1) has lost an electron.
- 2) has become an anion.
- 3) has been oxidized.
- 4) has achieved noble gas electron configuration.

A: 1,2 B: 2,3 C: 3,4 D: 2,4 E: 2,3,4

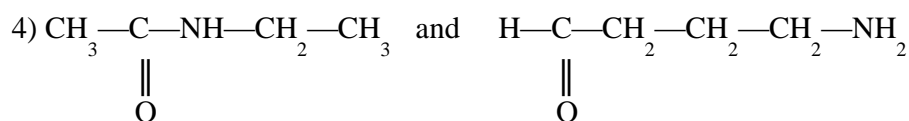
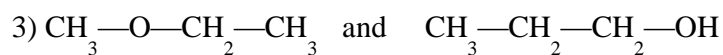
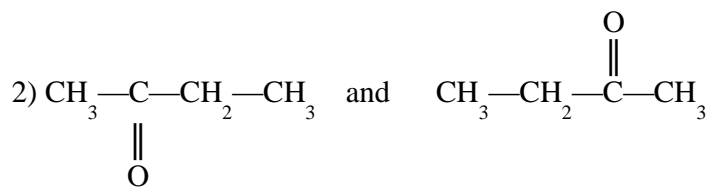
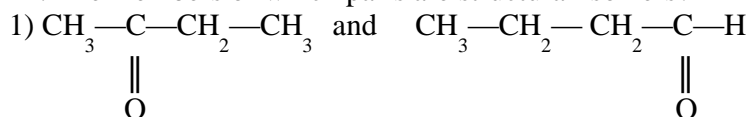
12. What is the oxidation number of *Cr* in $K_2Cr_2O_7$

- A: -6
- B: +6
- C: +12
- D: -12
- E: +2

13. Choose the compound with an ester group.

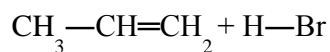


14. The members of which pairs are structural isomers?

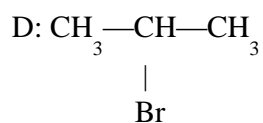
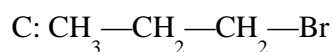
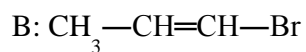
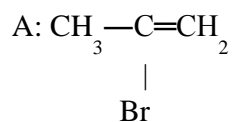


A: 1,2 B: 2,3 C: 1,3,4 D: 2,3,4 E: 1,2,3,4

15. The main organic product in the following reaction:



is:



E: there will be no reaction

16. Which substance could be decomposed by chemical reactions?

1. water
2. sugar
3. mercury
4. argon

A: 1, 2 B: 2, 3 C: 3, 4 D: 2, 4

17. What is the volume of 8.8g CO₂ at STP Mw (CO₂) = 44

- A. 22.4 L
- B. 2.24 L
- C. 44.8 L
- D. 4.48 L

18. Under the symbol of 2 SO₃ you may understand

- 1. 2 moles of SO₃
- 2. 2 molecules of SO₃
- 3. 6 moles of O₂
- 4. 2 x 6 x 10²³ O atoms

A: 1, 2 B: 2, 3 C: 3, 4 D: 1, 2, 3

19. Which of the following atoms are isotopes of each other?

- 1. X: 11 protons, 12 neutrons
- 2. Y: 11 protons, 11 neutrons
- 3. V: 12 protons, 11 neutrons
- 4. W: 11 protons, 13 neutrons

A: 1, 3 B: 1,2,4 C: all of them D: none of them .

20. Which main energy shell can accommodate a maximum number of 8 electrons?

- A. 1
- B. 2
- C. 3
- D. all of them

21. An element has the electronic configuration of 1s² 2s² 2p⁶ 3s² 3p². The number of valence electrons is

- A. 2
- B. 4
- C. 12
- D. 14

22. Which group of the periodic table is called halogens?

- A. II A

- B. IV A
- C. VI A
- D. VII A

23. Magnesium forms an ion with a charge of

- A. 1+ by losing one electron
- B. 1- by gaining one electron
- C. 2+ by losing two electrons
- D. 2- by gaining two electrons

24. Which molecules contain polar covalent bonds?

- 1. CO_2
- 2. CCl_4
- 3. F_2
- 4. KF

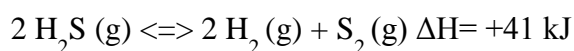
A: 1,2 B: 2, 4 C: 1, 2, 3 D: 2, 3, 4

25. Ionic bond is likely to form between the atoms of

- 1. C and Br
- 2. Ca and I
- 3. P and Cl
- 4. O and Na

A: 1, 2 B: 2, 3 C: 2, 4 D: 1, 2, 4

26. Which of the following changes will shift the reaction at equilibrium to the left



- 1. increase the concentration of H_2S
- 2. decrease the temperature
- 3. increase the pressure
- 4. increase the concentration of H_2

A: 1, 2 B: 1, 2, 3 C: 2, 3, 4 D: 1, 2, 3, 4

27. Which solution contains the largest amount of glucose?

- A. 0.5 L 2 M solution
- B. 50 mL 0.2 M solution
- C. 1000 mL 1 M solution
- D. 0.25 L 5 M solution

28. Choose the solution with the highest hydronium ion concentration.

- A. pH = 2 HCl solution
- B. pH = 2 acetic acid solution
- C. 0.1 M HCl solution
- D. 0.1 M acetic acid solution

29. The oxidation number of Mn in MnO_4^- is

- A. +1
- B. +8
- C. +7
- D. -7