
Test contains 15 questions, 2 marks each. **No negative marks.**

$N_A = 6 \times 10^{23} \text{ mol}^{-1}$; Ar: Na-23; S-32; O-16; H-1; Br-80; K-39.

1. Mass number (A) of the element E is 32 and electron configuration of its E^{2-} ion is $1s^2 2s^2 2p^6 3s^2 3p^6$. Which one of the following statements is correct?
 - 1) Neutral atom of the element E contains 20 electrons
 - 2) Neutral atom of the element E contains 18 protons
 - 3) Element E is a noble gas
 - 4) Neutral atom of the element E contains 16 neutrons

2. Given: $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$

Initially, 1 mol SO_2 and 2 mol O_2 are placed in a 1 L vessel. After equilibrium has been established, 0.5 mol SO_3 is present in the vessel. The vessel contains:

 - 1) 0.5 mol/L SO_2 , 1 mol/L O_2 and 0.5 mol/L SO_3
 - 2) 1 mol/L O_2 and 0.5 mol/L SO_3
 - 3) 0.5 mol/L SO_2 , 1.75 mol/L O_2 and 0.5 mol/L SO_3
 - 4) 0.5 mol/L SO_2 , 0.25 mol/L O_2 and 0.5 mol/L SO_3

3. Calculate the mass percent of Na_2SO_3 in a solution prepared by adding 25 g of $\text{Na}_2\text{SO}_3 \cdot 7\text{H}_2\text{O}$ and 25 g of Na_2SO_3 to 200 g of water.
 - 1) 25.0
 - 2) 20.0
 - 3) 18.75
 - 4) 15.0

4. In oxidation-reduction reaction between potassium bromide and potassium bromate (KBrO_3) in acidic solution (H_2SO_4) produce elemental bromine, potassium sulfate and water. What volume of 2 mol/L of reduction agent, in milliliters, is required to give 4.8 g bromine?
 - 1) 25
 - 2) 12.5
 - 3) 15
 - 4) 50

5. Which of the following has the lowest pH value?

- 1) solution which in 1 L contains 10^{-2} mol H^+
- 2) solution which in 1 L contains 6×10^{10} OH^-
- 3) solution of H_2SO_4 has a $pOH=11.5$
- 4) solution of H_3PO_4 has a $pH=3$

6. Which one of the following sets is arranged in order of decreasing pH of aqueous solutions of compounds?

- 1) $NaCl$, CO_2 , Na_2CO_3
- 2) HCl , $NaNO_3$, $NaNO_2$,
- 3) $NaCH_3COO$, $NaCl$, N_2O_3
- 4) $NaCN$, Na_2SO_4 , Na_2O

7. Which of the following reactions is **not possible**?

- 1) $Cu + 2HNO_3 \rightarrow Cu(NO_3)_2 + H_2$
- 2) $CaCO_3 + 2HNO_3 \rightarrow Ca(NO_3)_2 + CO_2 + H_2O$
- 3) $CuO + 2HCl \rightarrow CuCl_2 + H_2O$
- 4) $2Al + 2NaOH + 6H_2O \rightarrow 2Na[Al(OH)_4] + 3H_2$

8. Tertiary alcohol can be prepared in the reaction of:

- 1) aldehyde and alkyl-magnesium-chloride following acidic hydrolysis
- 2) cyclohexanone and methyl-magnesium-chloride following acidic hydrolysis
- 3) reduction of propanone with LiAlH_4 following acidic hydrolysis
- 4) reduction of ethyl-propanoate with LiAlH_4 following acidic hydrolysis

9. Esterification is a reversible process. In order to increase the yield of the product as much as possible it is necessary:

- 1) to avoid the use of inorganic acid as the catalyst
- 2) to remove H_2O from the reaction
- 3) to use reactants (carboxylic acid and alcohol) in 1:1 ratio
- 4) to add a reducing agent to the reaction mixture

10. 1,2,3,4-Tetrabromohexane is formed in the reaction of unknown starting compound and bromine. What is the structure of the unknown starting compound:

- 1) 1,5-hexadiene
- 2) 1,2-hexadiene
- 3) 1-hexyne
- 4) 1,3-hexadiene

11. The axial bonds in cyclohexane at positions 1 and 3 have the following relationship:

- 1) they are *cis* to each other
- 2) they are *trans* to each other
- 3) they do not have any defined relationship
- 4) their relationship can be either *cis* or *trans*

12. Which of the following statements is false:

- 1) substitution reactions are typical transformations of benzene
- 2) the length of C-C bond in benzene is between the length of the single (C-C) bond and the double (C=C) bond
- 3) all atoms in the benzene ring are in the same plane
- 4) the most stable conformation of benzene is the chair conformation

13. The reaction of anilinium-chloride and potassium hydroxide affords:

- 1) phenol
- 2) potassium salt of phenol and ammonium-chloride
- 3) chlorobenzene and ammonia
- 4) aniline

14. Schiff base can be prepared in the reaction of:

- 1) histamine and ammonia
- 2) phenylalanine and formaldehyde
- 3) histidine and ammonia
- 4) reduction of cystine

15. Which functional groups participate in the formation of the D-ribose pyranose structure:

- 1) the alcohol group at position 4 and the aldehyde group
- 2) the alcohol group at position 2 and the alcohol group at position 5
- 3) the alcohol group at position 5 and the aldehyde group
- 4) the primary alcohol group and any of the secondary alcohol group