

CaMO USNCO Local Exam Pre-Test

Local Section Diagnostic

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Rules: You have 50 minutes to complete this 27 question multiple choice exam. You may use a non programmable calculator. You are not allowed to access the internet during this exam. I will not aid you during this exam.

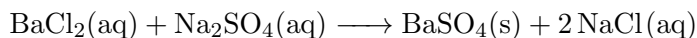
DO NOT TURN THE PAGE UNTIL DIRECTED TO DO SO

$$E = E^\circ - \frac{RT}{nF} \ln Q \quad \ln K = \left(\frac{-\Delta H^\circ}{R} \right) \left(\frac{1}{T} \right) + \text{constant} \quad \ln \left(\frac{k_2}{k_1} \right) = \frac{E_a}{R} \left(\frac{1}{T_1} - \frac{1}{T_2} \right)$$

1. How many atoms are in 4.0×10^{-5} grams of Al?

- (a) 8.9×10^{17}
- (b) 2.4×10^{19}
- (c) 6.5×10^{20}
- (d) 2.0×10^{22}

2. Barium chloride reacts with sodium sulfate according to the following equation:



A student mixes a solution containing 10.0 g BaCl_2 ($M = 208.2$) with a solution containing 10.0 g Na_2SO_4 ($M = 142.1$) and obtains 12.0 g BaSO_4 ($M = 233.2$). What is the percent yield of this reaction.

- (a) 60.0%
- (b) 73.1 %
- (c) 93.3 %
- (d) The isolated barium sulfate is most likely wet, since the yield would otherwise be greater than 100%

3. A 5.73 g sample of a liquid hydrocarbon burned in excess oxygen produces 17.48 g CO_2 . What is the formula of the hydrocarbon?

- (a) C_5H_{12}
- (b) C_6H_6
- (c) C_6H_{10}
- (d) C_6H_{12}

4. A student determined the density of a solid to be 2.90, 2.91, and 2.93 g cm^{-3} . If the actual density of this solid is 2.70 g cm^{-3} , how should the student's results be described?

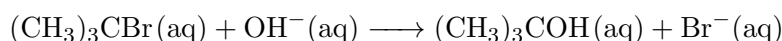
- (a) high accuracy and high precision
- (b) low accuracy and high precision
- (c) high accuracy and low precision
- (d) low accuracy and low precision

5. A flame test was performed to confirm the identity of a metal ion in solution. The result was a green flame. Which of the following metal ions is indicated?

- (a) copper
- (b) sodium
- (c) strontium
- (d) zinc

6. Which of the following is a weak electrolyte in aqueous solution?
- (a) HF
 - (b) NaF
 - (c) HCl
 - (d) KCl
7. A sample of He gas in a flexible container at room temperature exhibits a certain pressure. What will be the new pressure when the absolute temperature and volume of the container are both halved? The pressure of the He will be
- (a) the same
 - (b) doubled
 - (c) halved
 - (d) quadrupled
8. A gas mixture at 27 ° C and 1 atm contains equal masses of He, H₂, CO₂, and CH₄. How do their molecular velocities compare?
- (a) He = H₂ = CO₂ = CH₄
 - (b) He > H₂ > CO₂ > CH₄
 - (c) H₂ > He > CH₄ > CO₂
 - (d) CO₂ > CH₄ > He > H₂
9. The molecules in a sample of pure liquid dichloromethane, CH₂Cl₂, experience which of the following intermolecular forces?
- I dispersion forces
 - II dipole-dipole forces
 - III hydrogen bonding
- (a) I only
 - (b) II only
 - (c) I and II only
 - (d) I, II, III
10. The standard enthalpy of formation for NH₃(g) is -46.1 kJ mol⁻¹. Calculate ΔH° for the reaction:
- $$2 \text{NH}_3(\text{g}) \longrightarrow \text{N}_2(\text{g}) + 3 \text{H}_2(\text{g})$$
- (a) -92.2 kJ
 - (b) -46.1 kJ
 - (c) 46.1 kJ
 - (d) 92.2 kJ

11. Which is a statement of the Second Law of Thermodynamics?
- (a) The energy of the universe is conserved.
 - (b) The energy of the universe is decreasing.
 - (c) The entropy of the universe is conserved.
 - (d) The entropy of the universe is increasing.
12. A gold ring that weighs 3.81 g is heated to 84.0 °C and placed in 50.0 g of H₂O at 22.1 °C. What is the final temperature?
- (a) 22.2 °C
 - (b) 24.0 °C
 - (c) 26.5 °C
 - (d) 53.1 °C
13. The activation energy for a reaction can be determined by measuring the reaction rate at different
- (a) temperatures.
 - (b) catalyst concentrations.
 - (c) reactant concentrations.
 - (d) times on the reaction curve.
14. A catalyst speeds up a chemical reaction by
- (a) shifting the equilibrium.
 - (b) increasing the activation energy.
 - (c) decreasing the reaction enthalpy.
 - (d) providing an alternate reaction pathway.
15. For the reaction:



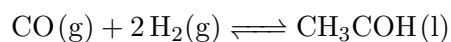
it is found that halving the concentration of (CH₃)₃CBr causes the reaction rate to be halved but halving the concentration of OH⁻ has no effect on the rate. What is the rate law?

- (a) $\text{Rate} = k [(\text{CH}_3)_3\text{CBr}]^{\frac{1}{2}} [\text{OH}^-]$
 - (b) $\text{Rate} = k [(\text{CH}_3)_3\text{CBr}]^2 [\text{OH}^-]$
 - (c) $\text{Rate} = k [(\text{CH}_3)_3\text{CBr}]^{\frac{1}{2}}$
 - (d) $\text{Rate} = k [(\text{CH}_3)_3\text{CBr}]$
16. What is the pH of a 0.0015 M solution of HNO₃?
- (a) 1.41
 - (b) 2.82
 - (c) 5.65
 - (d) 11.18

17. In a solution of formic acid ($K_a = 1.7 \times 10^{-4}$), the $[\text{H}^+] = 2.3 \times 10^{-3}$. What is the concentration of formic acid in mol L^{-1} ?

- (a) 7.2×10^{-2}
- (b) 3.1×10^{-2}
- (c) 5.3×10^{-6}
- (d) 3.9×10^{-7}

18. For the equilibrium system:



what is K_c ?

- (a) $K_c = \frac{[\text{CH}_3\text{OH}]}{2[\text{CO}][\text{H}_2]}$
- (b) $K_c = \frac{[\text{CH}_3\text{OH}]}{[\text{CO}][\text{H}_2]^2}$
- (c) $K_c = \frac{1}{2[\text{CO}][\text{H}_2]}$
- (d) $K_c = \frac{1}{[\text{CO}][\text{H}_2]^2}$

19. Which change represents an oxidation

- (a) $\text{NO}_2^- \longrightarrow \text{N}_2$
- (b) $\text{VO}^{2+} \longrightarrow \text{VO}_3^-$
- (c) $\text{ClO}^- \longrightarrow \text{Cl}^-$
- (d) $\text{CrO}_4^{2-} \longrightarrow \text{Cr}_2\text{O}_7^{2-}$

20. Which is a consistent set of values for a specific redox reaction carried out under standard conditions?

- | | E° | ΔG° | Description |
|-----|-----------|------------------|----------------|
| (a) | + | - | spontaneous |
| (b) | - | + | spontaneous |
| (c) | + | + | nonspontaneous |
| (d) | - | - | nonspontaneous |

21. For a galvanic cell involving the half-reactions at standard conditions,



what is E_{cell}° ?

- (a) 0.48 V
- (b) 1.16 V
- (c) 1.84 V
- (d) 2.52 V

22. Which set of quantum numbers is not possible?
- (a) $n = 2, l = 1, m_l = +1, m_s = -\frac{1}{2}$
 - (b) $n = 3, l = 2, m_l = +1, m_s = +\frac{1}{2}$
 - (c) $n = 4, l = 4, m_l = -1, m_s = +\frac{1}{2}$
 - (d) $n = 5, l = 2, m_l = 2, m_s = -\frac{1}{2}$
23. In which list are the ions arranged in order of decreasing size?
- (a) $\text{S}^{2-}, \text{Br}^-, \text{K}^+, \text{Ca}^{2+}$
 - (b) $\text{Br}^-, \text{S}^{2-}, \text{K}^+, \text{Ca}^{2+}$
 - (c) $\text{K}^+, \text{Ca}^{2+}, \text{S}^{2-}, \text{Br}^-$
 - (d) $\text{Ca}^{2+}, \text{K}^+, \text{S}^{2-}, \text{Br}^-$
24. The removal of an electron from which gaseous atom requires the greatest amount of energy?
- (a) Na
 - (b) Cl
 - (c) K
 - (d) Br
25. Which ionic solid has the greatest lattice energy?
- (a) NaCl
 - (b) MgO
 - (c) KBr
 - (d) SrS
26. What is the shape of the ClF_3 molecule?
- (a) trigonal planar
 - (b) trigonal pyramidal
 - (c) T-shaped
 - (d) tetrahedral
27. Which molecule has no permanent dipole moment?
- (a) BCl_3
 - (b) NCl_3
 - (c) CHCl_3
 - (d) PCl_3

END OF TEST