

CHEM 1332
SPRING 2005
Test 2 Version 1

1. What is the nucleus formed when ^{187}Re undergoes beta decay?
 (A) ^{187}Os (B) ^{187}W (C) ^{187}Mo (D) ^{187}Bh (E) ^{187}Sg
2. Calculate the binding energy per mole for ^{137}Ba (atomic mass, 136.905812 amu, mass of ^1H = 1.007885 amu, mass of a neutron = 1.008665 amu, $c = 2.997 \times 10^8 \text{ m/s}$)
 (A) $1.114 \times 10^{14} \text{ kJ/mol}$ (B) $1.114 \times 10^{11} \text{ kJ/mol}$
 (C) 138.143425 kJ/mol (D) 1.237613 kJ/mol
 (E) $1.114 \times 10^8 \text{ kJ/mol}$
3. Polonium does not have any stable isotopes because
 (A) its atomic number is larger than 83.
 (B) it has an odd number of protons.
 (C) all of its isotopes have a ratio of neutron to proton larger than 1.
 (D) all of above.
 (E) none of above.
4. The half-life of ^{32}P is 14.3 days. How much of 10.0 grams of ^{32}P will be left after 28.6 days?
 (A) 3.3 grams (B) 5.0 grams (C) 7.5 grams (D) 2.5 grams (E) 1.0 grams
5. The equilibrium constant K_P for the reaction $1/2 \text{O}_2(\text{g}) + \text{Hg}(\text{l}) \rightleftharpoons \text{HgO}(\text{s})$ is 9.1×10^{14} . What is K_P for the reaction $2 \text{HgO}(\text{s}) \rightleftharpoons 2 \text{Hg}(\text{l}) + \text{O}_2(\text{g})$?
 (A) 9.1×10^{14} (B) 1.2×10^{-30} (C) 1.1×10^{-15} (D) 4.2×10^{29} (E) 8.3×10^{29}

6. The reaction $2 \text{NO}_2(\text{g}) \rightleftharpoons \text{N}_2(\text{g}) + 2 \text{O}_2(\text{g})$ is important to catalytic converters and air pollution. What is K_c for this reaction given that:



- (A) 4.8×10^{13} (B) 2.3×10^4 (C) 4.4×10^{-5} (D) 5.3×10^{-15} (E) 2.1×10^{-14}

7. What effect does a) increasing the total pressure and b) increasing the temperature have on the equilibrium $\text{H}_2(\text{g}) + \text{CO}_2(\text{g}) \rightleftharpoons \text{H}_2\text{O}(\text{g}) + \text{CO}(\text{g})$, $\Delta H^\circ = 41.2 \text{ kJ/mol}$.

- (A) a) equilibrium shifts towards products, b) equilibrium shifts towards products.
 (B) a) equilibrium shifts towards reactants, b) equilibrium shifts towards products.
 (C) a) equilibrium shifts towards products, b) equilibrium shifts towards reactants.
 (D) a) no change in the equilibrium, b) equilibrium shifts towards products.
 (E) a) no change in the equilibrium, b) equilibrium shifts towards reactants.

8. Which answer best describes the reaction $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$ in a closed 3.50 L reaction vessel at 200 °C if initially there are 0.249 mol N_2 , 3.21×10^{-2} mol H_2 , and 6.42×10^{-4} mol NH_3 ($K_c = 0.65$ at 200 °C).

- (A) $Q_c = 0.613$, reaction will proceed to the right. (B) $Q_c = 1.64$, reaction will proceed to the left.
 (C) $Q_c = 0.613$, reaction will proceed to the left. (D) $Q_c = 0.613$, the reaction is at equilibrium
 (E) $Q_c = 0.0499$, the reaction will proceed to the right.

9. For the reaction $\text{NH}_4\text{CO}_2\text{NH}_2(\text{s}) \rightleftharpoons \text{CO}_2(\text{g}) + 2\text{NH}_3(\text{g})$, starting only with the solid it is found that at 40 °C the total pressure at equilibrium is 0.363 atm. What is K_p for the reaction?

- (A) 1.42×10^{-2} (B) 4.78×10^{-2} (C) 7.09×10^{-3} (D) 141 (E) 1.77×10^{-3}

10. For the reaction $2\text{NO}(\text{g}) + \text{Cl}_2(\text{g}) \rightleftharpoons 2\text{NOCl}(\text{g})$, K_P is 6.5×10^4 at 308 K. If at equilibrium partial pressure of $\text{NO} = 0.35$ atm and that of $\text{Cl}_2 = 0.10$ atm, what is the partial pressure of $\text{NOCl}(\text{g})$?
- (A) 28 atm (B) 800 atm (C) 3.5×10^{-2} atm (D) 1.3×10^{-3} atm (E) 0.035 atm
11. What is the value of K_c for the reaction $\text{H}_2(\text{g}) + \text{F}_2(\text{g}) \rightleftharpoons 2\text{HF}(\text{g})$ given that when 0.010 mol H_2 and 0.050 mol F_2 are added to a 1.00 L container, 0.0125 mol HF is present at equilibrium.
- (A) 2.50×10^1 (B) 9.5×10^{-1}
 (C) 7.53×10^1 (D) 4.00×10^{-2}
 (E) Cannot be determined from the information given.
12. For the reaction $2\text{NO}(\text{g}) + \text{Cl}_2(\text{g}) \rightleftharpoons 2\text{NOCl}(\text{g})$, K_P is 6.5×10^4 at 308 K. Calculate the value of K_c at this temperature.
- (A) 6.5×10^4 (B) 1.6×10^6 (C) 2.6×10^3 (D) 3.1×10^6 (E) 1.7×10^8
13. Which of the following substances is incorrectly described?
- (A) Sodium hydroxide is a strong base according to the Arrhenius and Bronsted-Lowry descriptions.
 (B) Hydrofluoric acid is a weak acid according to the Arrhenius and Bronsted-Lowry descriptions.
 (C) Water is both an acid and a base according to the Arrhenius and Bronsted-Lowry description
 (D) Ammonia is a weak base according to the Arrhenius and Bronsted-Lowry descriptions.
 (E) All of these substances are correctly described.
14. Calculate the pH of a solution of 0.25 M $\text{Sr}(\text{OH})_2$.
- (A) 0.602 (B) 0.301 (C) 13.699 (D) 13.398 (E) 14.602
15. A 0.25 M solution of a newly discovered weak acid has a pH of 3.5. Calculate the K_a of the acid?
- (A) 3.16×10^{-4} (B) 4.00×10^{-7} (C) 4.00×10^{-6} (D) 1.00×10^{-7} (E) 7.91×10^{-5}

16. Calculate the pH of a solution of 0.35 M HBrO₂, given that the K_a of HBrO₂ is 5.3×10^{-5} .
- (A) 4.73 (B) 9.27 (C) 2.37 (D) 11.63 (E) 4.28
17. Calculate the pH of a solution of 0.450 M NH₃, given that the K_b of NH₃ is 1.80×10^{-5} .
- (A) 11.45 (B) 8.91 (C) 2.55 (D) 5.09 (E) 9.20
18. Compare the substances, HClO₃, H₃PO₃, HBr, H₃PO₄ and HF. Which of the following statements is false?
- (A) HClO₃ is a weaker acid than HBr
 (B) H₃PO₃ is a weaker acid than H₃PO₄
 (C) HClO₃ is a stronger acid than H₃PO₃
 (D) HF is a stronger acid than HBr
 (E) The anion ClO₃⁻ is a weaker base than the anion H₂PO₃⁻
19. Which of the following solutions is incorrectly described?
- (A) 0.25 M NaH would be basic
 (B) 0.15 M KBr would be neutral
 (C) 0.25 M NH₄Cl would be acidic
 (D) 0.15 M HN₃ would be acidic
 (E) 0.20 M HClO would be basic
20. Calculate the pH of a solution of 0.300 M RbF, given that the K_a of HF is 7.20×10^{-4} .
- (A) 8.31 (B) 12.2 (C) 5.69 (D) 8.81 (E) 1.83