

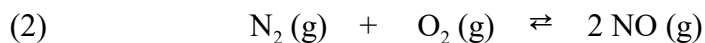
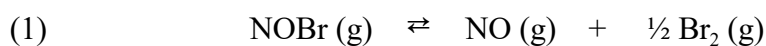
Practice Problems for Final - New Material Only

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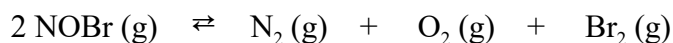
This practice exam covers only the new material from chapters 15, 16, 19 and 20. The actual **final** is **cumulative** and **covers ALL material from the semester.**

1. The balanced homogeneous vapor-phase reaction $A + B \rightleftharpoons X + Y$ has $K_c = 9.5 \times 10^{-33}$ at 472 K. At equilibrium (pick the BEST answer)
- a) products predominate (mostly products but measurable amounts of reactants)
 - b) reactants predominate (mostly reactants but measurable amounts of products)
 - c) roughly equal molar amounts of products and reactants are present
 - d) essentially only products exist
 - e) essentially only reactants exist

2. Given the following two equilibrium reactions,

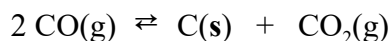


What is the equilibrium constant, K , for the reaction below,



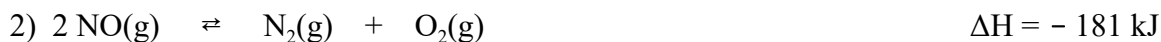
- a) $K = K_1^2 K_2^{-1}$
- b) $K = K_1^{-1} K_2^2$
- c) $K = K_1^2 K_2$
- d) $K = \frac{1}{2} K_1 K_2^{-1}$
- e) $K = (K_2 - 2K_1)$

3. The equilibrium constant K_c for the following reaction at 800.0 °C is 7.14×10^{-2} . What is K_p at this temperature?



- a) 7.14×10^{-2}
- b) 8.11×10^{-4}
- c) 5.92×10^2
- d) 6.29
- e) 9.22×10^{-6}

4. Consider the reactions given below. In which case(s) will the reaction proceed more to the **RIGHT** by **increasing** the **pressure**?



- a) 3, 4 b) 1, 5 c) 1, 4, 5 d) 2, 3, 4 e) 1, 2, 3

5. For which of the following reactions is **REACTANT** formation favored by **low pressure** **AND** **high temperature**?



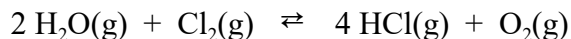
- a) 1 b) 2 c) 3 d) 4 e) 5

6. Consider the following reactions at equilibrium and determine which of the indicated changes will cause the reaction to proceed to the **right**. We are considering small changes in a substance (i.e. adding or removing small amounts)

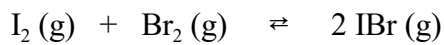


- a) 1, 4 b) 3, 4 c) 2, 3 d) 2, 3, 5 e) 1, 4, 5

7. If the **temperature** of the following endothermic reaction, already at equilibrium, is **raised** from 50°C to 100°C, in which direction will the reaction shift **AND** how will this affect the value of the equilibrium constant?



- a) shift in forward direction, K will decrease
b) shift in reverse direction, K will decrease
c) shift in forward direction, K will increase
d) shift in reverse direction, K will increase
e) shift in forward direction, K will not change
8. For the following system, 0.400 moles of I₂, 0.400 moles of Br₂ and 2.10 moles of IBr are placed in a **2.00**- L flask. The value of K_c for the reaction is 110.25. What are the concentrations (M) of **Br₂** and **IBr** (in this order) when equilibrium is reached?



- a) 0.116, 1.22 b) 0.109, 1.14 c) 0.100, 1.05
d) 0.013, 1.42 e) none of these

9. What is the **conjugate base** of methylamine, CH₃NH₂?

- a) CH₃NH⁺ b) CH₃NH₂⁻ c) CH₃NH₂⁺ d) CH₃NH₃⁺ e) CH₃NH⁻

10. Given that K_w for water is 2.40×10^{-14} (M^2) at $37^\circ C$, compute the pH of a neutral aqueous solution at $37^\circ C$ (normal human body temperature). Answer the following **TWO** questions. What is the pH of a neutral solution at $37^\circ C$? **AND** If a solution has $pH = 7.00$ is it acidic, basic, or neutral at $37^\circ C$?
- a) 7.19, acidic b) 7.19, basic c) 6.81, acidic
d) 6.81, basic e) 7.00, neutral
11. The pH of a 0.10 M solution of NH_4Cl containing 0.10 M NH_3 is 9.20. What is the $[H_3O^+]$?
- a) 1.6×10^{-5} b) 1.0×10^{-1} c) 6.3×10^{-10}
d) 1.7×10^{-10} e) 2.0×10^{-9}

12. The K_a values for HS^- and HPO_4^{2-} are 1.2×10^{-13} and 4.8×10^{-13} respectively. Therefore it follows the HS^- is a ___ acid than HPO_4^{2-} and S^{2-} is a ___ base than PO_4^{3-} .
- a) stronger, stronger b) stronger, weaker
c) weaker, stronger d) weaker, weaker
13. What is the **ionization constant** of an acid if the hydronium ion concentration of a 0.500 M solution is 1.70×10^{-4} M?
- a) 3.62×10^{-7} b) 2.89×10^{-8} c) 5.80×10^{-8}
d) 1.16×10^{-7} e) 1.70×10^{-3}

14. A 0.010 M solution of HNO_2 is 19% ionized. What is the K_a ?

a) 4.4×10^{-4}

b) 3.9×10^{-4}

c) 3.6×10^{-4}

d) 5.0×10^{-4}

e) 5.4×10^{-4}

15. What is the **pH** of a 0.20 M NH_4^+ solution ($K_b: \text{NH}_3 = 1.8 \times 10^{-5}$)?

a) 2.72

b) 3.11

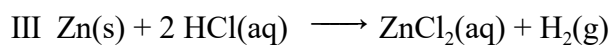
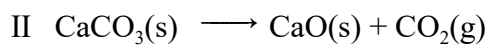
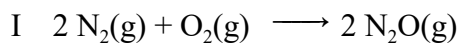
c) 4.98

d) 5.12

e) 7.61

16. A 1.50 g sample of Vitamin C is dissolved in 100.0 mL of water and titrated with 0.250 M NaOH to the methyl orange equivalence point. The volume of the base used is 34.1 mL. What is the **molecular weight** of Vitamin C assuming one dissociable proton per molecule?
- a) 176 b) 164 c) 152 d) 146 e) 139

17. Predict which of the following reactions has a positive entropy change.



a) I

b) II

c) III

d) I and II

e) II and III

18. Calculate the ΔS (J/mol•K) of fusion for ethane which melts at -183°C . The heat of fusion is 2.86 kJ/mole.

a) 21.4

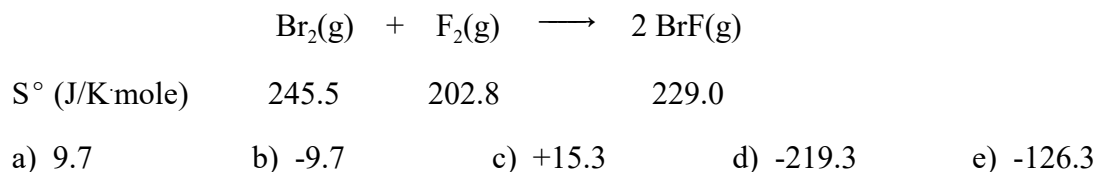
b) 31.8

c) 15.6

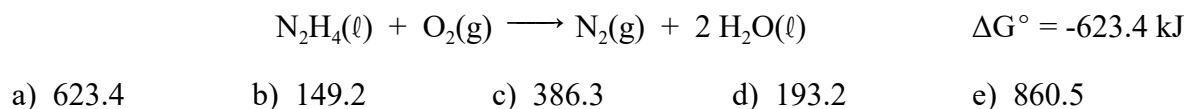
d) 28.1

e) 34.3

19. Calculate the entropy change (J/mole•K) of the reaction. The molar entropies are given below each substance.



20. The standard free energy of formation of $\text{H}_2\text{O}(\ell)$ is -237.1 kJ/mol. Using the data for the following reaction, calculate the free energy of formation, ΔG_f° , for $\text{N}_2\text{H}_4(\ell)$ (in kJ/mol).



21. Consider the ΔG_f° and ΔH_f° (kJ/mole) for the following oxides. Which oxide can be **most easily decomposed** to form the metal and oxygen gas.

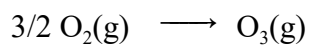
	ΔG_f°	ΔH_f°
a) PbO	-187.9	-217.3
b) ZnO	-318.4	-348.3
c) Ag ₂ O	-11.2	-31.1
d) CdO	-228.4	-258.2

22. From the following ΔH° and ΔS° values predict which of reactions I, II, and III would be spontaneous at 25°C .

	$\Delta H^\circ(\text{kJ})$	$\Delta S^\circ(\text{J/K})$
I	-5.0	-20
II	-10.0	-10
III	-25.0	+75

- a) I b) II c) III d) I and II e) II and III

23. The $K_p = 2.47 \times 10^{-29}$ at 25°C for the following reaction. Calculate ΔG° (kJ).



- a) 157 b) 163 c) 169 d) 172 e) 175

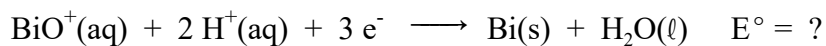
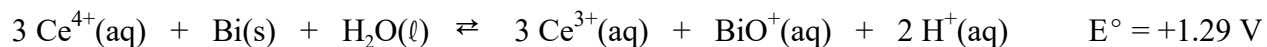
- a) -47.4 b) +20.5 c) +5.7 d) -20.5 e) -5.7

26. From the listed standard electrode potentials, what is E° for a voltaic cell made from the following electrodes?



- a) +2.227 b) 2.499 c) -2.227 d) -2.499 e) +1.113

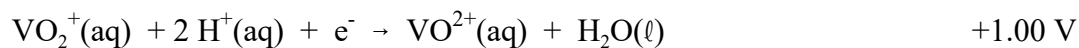
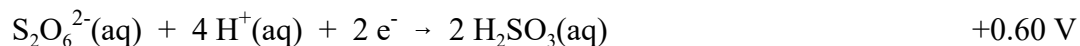
27. The $E^\circ = 1.29 \text{ V}$ for the following reaction. The standard electrode potential for Ce^{4+} as written is +1.61 V. What is the standard electrode potential for the reduction of BiO^+ ?



- a) -0.32 b) +0.32 c) +2.90 d) -2.90 e) -1.45

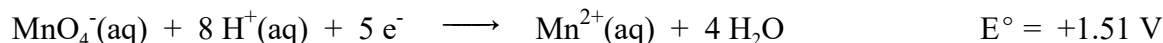
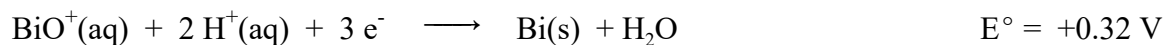
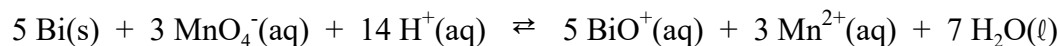
28. Consider the following half-cell reactions and associated standard half-cell potentials and determine which species is the **best reducing** agent.

E°



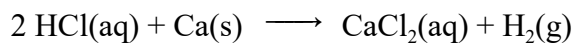
- a) Fe^{2+} b) H_2SO_3 c) N_2 d) VO^{2+} e) VO_2^+

29. Use the following E° for the electrode potentials, calculate ΔG° in kJ for the indicated reaction.



- a) -1.72×10^2 b) -1.42×10^2 c) -1.20×10^4
 d) -1.72×10^3 e) -1.42×10^3

30. Consider an electrochemical cell in which the following reaction occurs and predict which changes will increase the cell voltage.



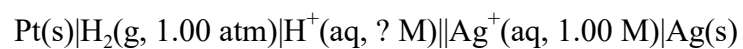
- I increase the amount of Ca(s)
- II decrease the pressure of H₂(g)
- III decrease the [HCl(aq)]

- a) I b) II c) III d) I & II e) II & III

31. Which of the following is characteristic of the **anode** in an **electrolysis** cell?

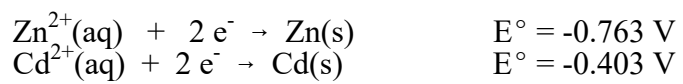
- a) It is where reduction occurs.
- b) It attracts negative ions.
- c) It receives electrons from the wire.
- d) It may gain weight during electrolysis.
- e) More than one of the above is correct.

32. The standard electrode potential of Ag^+ is 0.800. The measured voltage of the following cell is 0.900 V at 25°C . Calculate the **pH** of the solution.



- a) 1.69 b) 3.38 c) 1.12 d) 2.15 e) 2.78

33. Using standard electrode potentials, calculate the ΔG (kJ) for the following electrochemical cell



- a) 67.0 b) -69.5 c) -73.4 d) -65.0 e) 71.5

34. How many minutes will it take an electric current of 3.64 A to deposit all the copper from 740 mL of 0.250 M $\text{CuSO}_4(\text{aq})$? (atomic weight: Cu = 53.55)
- a) 182 b) 163 c) 144 d) 102 e) 98

Answers to Practice “Final” Problems

- | | | |
|-------|-------|-------|
| 1) E | 13) C | 25) C |
| 2) A | 14) A | 26) A |
| 3) B | 15) C | 27) B |
| 4) C | 16) A | 28) B |
| 5) A | 17) E | 29) D |
| 6) A | 18) B | 30) B |
| 7) C | 19) A | 31) B |
| 8) A | 20) B | 32) A |
| 9) E | 21) C | 33) C |
| 10) D | 22) E | 34) B |
| 11) C | 23) B | |
| 12) C | 24) B | |