

KEY

NAME:

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By signing this Exam Sheet, I declare that I will not share with my colleagues the content of the questions I received during this Exam. I also certify that the work I did was mine. I am affirming that I will not cheat and that I will uphold the Bearcat Bond.

This examination will cover material from Chapters 4 and 6. This Exam Sheet contains 25 Multiple-Choice problems on 6 pages (including this one). Please count the number of pages and problems to ensure that you have a complete examination before you begin working. Please make sure that the Exam Answer Sheet version and the version of this booklet are the same.

Please write your name as it appears on Canvas and M-number (without the M) on the cover page of your answer sheet and be certain that all 25 of your answers are filled in on the Exam Answer Sheet.

Answer Multiple-Choice Problem on the provided Exam Answer Sheet. Only the answers marked on your Exam Answer Sheet will be scored. Be sure to mark your answer clearly.

You are encouraged to write out your work on this exam packet. You may tear off the equation sheet/periodic table at the end of this exam packet.

You have 55 minutes to complete all problems. This is a close book examination which means you cannot use lecture notes/textbook/recitation notes to solve problems, and you have to work alone.

When finished, please turn in your Exam Answer Sheet, question booklet, and scratch paper to a TA at the front of the room and show them your Bearcat card.

Good Luck!

- 1) What are the major ionic species present in solution when $\text{Mg}(\text{NO}_3)_2$ is dissolved in water?
- A) only N^{2-}
 B) N^{2-} , Mg^{2+} , and O^{2-}
 C) Mg^{2+} and H_2O
 D) Mg^{2+} , N_2 , and O^{2-}
 E) Mg^{2+} and NO_3^-
- 2) 2. How many total moles of ions are in an aqueous solution that has 2.0 moles of $(\text{NH}_4)_2\text{S}$ dissolved in water?
- A) 4.0 total moles of ions
 B) 22 total moles of ions
 C) 6.0 total moles of ions
 D) 1.0 total moles of ions
 E) 8.0 total moles of ions
- 3) How many grams of Na_2S (78.0 g/mole) are needed to make 487 mL of a 0.689 M Na_2S solution?
- A) 5.51×10^7 g
 B) 287 g
 C) 55.1 g
 D) 26.2 g
 E) 4.30×10^{-3} g
- 4) A chemist dilutes 23.5 mL of a 4.68 M KNO_2 solution to a final concentration of 1.54 M. What is the solution's final volume?
- A) 71.4 mL
 B) 0.0140 mL
 C) 169 mL
 D) 0.307 mL
 E) 7.73 mL
- 5) Consider: $3\text{MgSO}_4(\text{aq}) + 2\text{Na}_3\text{PO}_4(\text{aq}) \rightarrow \text{Mg}_3(\text{PO}_4)_2(\text{s}) + 3\text{Na}_2\text{SO}_4(\text{aq})$
 What is the theoretical yield in grams of $\text{Mg}_3(\text{PO}_4)_2(\text{s})$ (263 g/mol) if 435 mL of 2.43 M MgSO_4 reacts with excess Na_3PO_4 ?
- A) 114 g
 B) 92.7 g
 C) 834 g
 D) 147 g
 E) 278 g
- 6) What is the total ionic equation when the following two reactants react? $\text{ZnSO}_4(\text{aq}) + 2\text{NaOH}(\text{aq}) \rightarrow$
- A) $\text{Zn}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) + 2\text{Na}^+(\text{aq}) + 2\text{OH}^-(\text{aq}) \rightarrow \text{Zn}(\text{OH})_2(\text{s}) + 2\text{Na}^+(\text{aq}) + \text{SO}_4^{2-}(\text{aq})$
 B) $\text{Zn}^{2+}(\text{aq}) + 2\text{OH}^-(\text{aq}) \rightarrow \text{Zn}(\text{OH})_2(\text{s})$
 C) $2\text{Na}^+(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{Na}_2\text{SO}_4(\text{aq})$
 D) $\text{ZnSO}_4(\text{aq}) + 2\text{NaOH}(\text{aq}) \rightarrow \text{Zn}(\text{OH})_2(\text{s}) + \text{Na}_2\text{SO}_4(\text{aq})$
 E) $\text{SO}_4^{2-}(\text{aq}) + 2\text{Na}^+(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{OH}^-(\text{aq})$
- 7) What are the spectator ions in the following reaction:
 $\text{BaCl}_2(\text{aq}) + \text{K}_2\text{CO}_3(\text{aq}) \rightarrow \text{BaCO}_3(\text{s}) + 2\text{KCl}(\text{aq})$
- A) There are no spectator ions.
 B) Ba^{2+} and CO_3^{2-}
 C) K^+ and Cl^-
 D) Ba^{2+} and Cl^-
 E) K^+ and CO_3^{2-}
- 8) What is the net ionic equation when the following two reactants react? $\text{NaOH}(\text{aq}) + \text{HCl}(\text{aq}) \rightarrow$
- A) $\text{Na}^+(\text{aq}) + \text{OH}^-(\text{aq}) + \text{H}^+(\text{aq}) + \text{Cl}^-(\text{aq}) \rightarrow \text{NaH}(\text{s}) + \text{ClOH}(\text{aq})$
 B) $\text{OH}^-(\text{aq}) + \text{H}^+(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l})$
 C) $\text{Na}^+(\text{aq}) + \text{Cl}^-(\text{aq}) \rightarrow \text{NaCl}(\text{aq})$
 D) no reaction occurs
 E) $\text{NaOH}(\text{aq}) + \text{HCl}(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l}) + \text{KCl}(\text{s})$
- 9) Which of the following is considered the strongest electrolyte?
- A) $\text{CH}_3\text{CO}_2\text{H}$
 B) SiO_2
 C) NH_3
 D) KCl
 E) Ne
- 10) What was the molarity of the HCl solution if 145 mL of a 1.28 M $\text{Ba}(\text{OH})_2$ solution was used to neutralize 235 mL of an HCl solution for the following balanced reaction:
 $\text{Ba}(\text{OH})_2(\text{aq}) + 2\text{HCl}(\text{aq}) \rightarrow \text{BaCl}_2(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$
- A) 2.07 M
 B) 0.790 M
 C) 1.58 M
 D) 0.186 M
 E) 0.371 M

11) The oxidation number of the element Si in Na_2SiO_3 is

- A) +4
- B) +6
- C) +3
- D) -2
- E) -6

Oxidation numbers:

O	$\Rightarrow -2 \times 3$	$= -6$
Na	$\Rightarrow +1 \times 2$	$= +2$
Si	$\Rightarrow +4 \times 1$	$= +4$
SUM		$= 0$

12) What species is reduced in the following reaction?



- A) $\text{Pb}(s)$
- B) $\text{Sn}(s)$
- C) $\text{Sn}^{2+}(aq)$
- D) $\text{Pb}^{2+}(aq)$
- E) No species is reduced.



13) Which species is the reducing agent in the following reaction:



- A) nothing is the reducing agent
- B) $\text{H}_2\text{O}(g)$
- C) $\text{Ag}(s)$
- D) $\text{Ag}_2\text{O}(s)$
- E) $\text{H}_2(g)$

$\text{H}_2(g)$ is reducing agent because



14) The oxidation number of the element Pt in PtO_3^{2-} is

- A) +6
- B) +4
- C) +2
- D) +3
- E) +5

Oxidation numbers:

O	$\Rightarrow -2 \times 3$	$= -6$
Pt	$\Rightarrow +4 \times 1$	$= +4$
SUM		$= -2$

15) Classify the following reaction from the choices below:



- A) precipitation
- B) single displacement
- C) decomposition
- D) acid-base
- E) combination

16) For the chemical equation below, the reaction is _____ because energy is _____.



- A) endothermic, released
- B) isothermic, conserved
- C) endothermic, absorbed
- D) exothermic, absorbed
- E) exothermic, released

17) Consider a system which does no work on the surroundings, and no work is done by the surroundings on the system. What is true about the values of ΔE and q for the system if heat is absorbed by the system?

- A) ΔE is positive and q is negative
- B) no conclusion can be made
- C) ΔE is negative and q is positive
- D) ΔE is negative and q is negative
- E) ΔE is positive and q is positive

18) Consider a system that absorbs 139 J of heat and does 754 J of work on the surroundings. What is the ΔE of the system?

- A) -893 J
 - B) -615 J
 - C) 893 J
 - D) 615 J
 - E) -754 J
- q absorbed > 0
 w done on the surrounding < 0
 $\Delta E = q + w = 139 \text{ J} + (-754 \text{ J}) = -615 \text{ J}$

19) For which from the following reactions ΔH (or q_p) WILL BE approximately (or exactly) equal to ΔE ?

- A) $\text{CH}_4(g) + 2\text{O}_2(g) \rightarrow \text{CO}_2(g) + 2\text{H}_2\text{O}(l)$
- B) $\text{I}_2(s) \rightarrow \text{I}_2(g)$
- C) $\text{N}_2(g) + \text{O}_2(g) \rightarrow 2\text{NO}(g)$
- D) $\text{CH}_3\text{OCH}_3(l) \rightarrow \text{CH}_3\text{OCH}_3(g)$
- E) $\text{Na}_2\text{CO}_3(s) \rightarrow \text{Na}_2\text{O}(s) + \text{CO}_2(g)$

20) Wood has a specific heat capacity of $1.76 \frac{\text{J}}{\text{g K}}$. Calculate the heat absorbed (q) in kJ when 550. g of a wood sample is heated from 38°C to 78°C . $1000 \text{ J} = 1 \text{ kJ}$.

- A) 12.5 kJ
 - B) 75.5 kJ
 - C) 36.8 kJ
 - D) 38.7 kJ
 - E) 41.3 kJ
- $\Delta T = 78^\circ\text{C} - 38^\circ\text{C} = 40^\circ\text{C} = 40 \text{ K}$
 $q = mc\Delta T = 550. \text{ g} \times 1.76 \frac{\text{J}}{\text{g K}} \times 40 \text{ K} \times \frac{1 \text{ kJ}}{1000 \text{ J}} = 38.7 \text{ kJ}$