

CHM 2045, Summer 2020

Exam Packet Instructions: Do your best and don't be anxious. Read the question, re-read the question, write down all given or valuable information, and write down what you want to find.

- Which formula is properly named?
(1) C_7H_{16} , septane
(2) $Mg(NO_3)_2$, magnesium(II) nitrate
(3) Na_2SO_3 , sodium sulfite
(4) $FeCl_2$, iron dichloride
(5) NO_2 , mononitrogen dioxide
- The radioactive ^{55}Mn isotope has which Z, neutron number, and A (respectively)?
(1) 25, 55, 30 (2) 12, 24, 55 **(3)** 25, 30, 55 (4) 23, 81, 35 (5) 12, 27, 11
- A sample of a hydrocarbon produced 3.14 grams of CO_2 and 1.28 grams of H_2O during combustion analysis. If the hydrocarbon has a molar mass of approximately 56 g/mol, what is the molecular formula?
(1) CH_2 (2) C_3H_6 (3) C_3H_{20} **(4)** C_4H_8 (5) C_2H_4
- Use oxidation numbers to decide whether each of the following is a redox reaction or not.
I) $MnO_4^- (s) + SO_3^{2-} (aq) + H^+ (g) \rightarrow Mn^{2+} (aq) + SO_4^{2-} (aq) + H_2O (l)$
II) $4 KNO_3 (s) \rightarrow 2 K_2O(s) + 2 N_2(g) + 5 O_2(g)$
III) $NaHSO_4 (aq) + NaOH (aq) \rightarrow Na_2SO_4 (aq) + H_2O (l)$
(1) I and III only (2) II only (3) II and III only **(4)** I and II only (5) I, II, and III
- Elemental magnesium consists of 3 isotopes: ^{24}Mg with an accurate mass of 23.99 amu, ^{25}Mg with an accurate mass of 24.99 amu, and ^{26}Mg with an accurate mass of 25.99 amu. If ^{24}Mg is 79% of naturally occurring magnesium, what is the percent abundance of ^{26}Mg ?
(1) 10% **(2)** 11% (3) 15% (4) 19% (5) 21%
- Which of the following acid base reactions show the acids correctly highlighted?
(1) $H_2CO_3 (aq) + H_2O(l) \rightarrow H_3O^+(aq) + HCO_3^- (aq)$
(2) $H_2O(l) + NH_3(aq) \rightarrow OH^-(aq) + NH_4^+(aq)$
(3) $HI(aq) + NaOH(aq) \rightarrow H_2O (l) + Na^+(aq) + I^- (aq)$
(4) $NH_4^+(aq) + HCO_3^-(aq) \rightarrow H_2CO_3(aq) + NH_3(aq)$
(5) $HNO_3(aq) + H_2O(l) \rightarrow H_3O^+(aq) + NO_3^-(aq)$

7. A 1.0 kg bottle of sodium carbonate (Na_2CO_3 , 106.0 g/mol) is available to clean up 5.00 liters of spilled concentrated aqueous hydrochloric acid (9.75 M). Is this enough sodium carbonate to neutralize the acid according to the following reaction?



- (1) No, there is approximately 40% too small amount of sodium carbonate needed.
(2) Yes, there is approximately 80% more than what is needed.
(3) No, there is approximately 60% too small amount of sodium carbonate needed. ☒
(4) Yes, there is exactly enough sodium carbonate, but no excess.
(5) No, there is approximately 20% too small amount of sodium carbonate needed.
8. How many grams of precipitate will form if 0.2 kg of Na_3PO_4 (164 g/mol) is added to 2.25 liters of 0.793 M of $\text{Ni}(\text{CH}_3\text{COO})_2$?

- (1) 223.25 g (2) 0.223 g (3) 0.2178 g (4) 366.1 g ☒ 217.7 g

9. Which of the following reactions is not classified correctly?

- (1) $\text{NaOH (aq)} + \text{HCl (aq)} \rightarrow \text{H}_2\text{O} + \text{NaCl}$ is both a Bronstead Lowry Acid Base and a precipitation (ppt) reaction. ☒
(2) $\text{CH}_3\text{OH(g)} + \text{O}_2\text{(g)} \rightarrow \text{CO}_2 \text{ (g)} + \text{H}_2\text{O(g)}$ is a combustion and a redox reaction
(3) $\text{NH}_4^+ \text{ (aq)} + \text{H}_2\text{O(l)} \rightarrow \text{NH}_3\text{(aq)} + \text{H}_3\text{O}^+\text{(aq)}$ is a Bronstead Lowry Acid Base Reaction
(4) $\text{Na(s)} + \text{Cl}_2\text{(g)} \rightarrow \text{NaCl}$ is a redox reaction
(5) All the reactions are classified correctly

10. If 76.0 mL of 1.85 M NaOH is required to neutralize 91.00 mL of a sulfuric acid, H_2SO_4 , solution, what is the molarity of the sulfuric acid?

- (1) 0.193 M H_2SO_4 (2) 0.386 M H_2SO_4 ☒ 0.773 M H_2SO_4 (4) 1.55 M H_2SO_4
(5) 3.10 M H_2SO_4

11. Which of the following is false?

- (1) If there is no net ionic equation, no precipitation reaction occurs within an aqueous system
(2) A formula unit of copper (II) sulfate contains less ions than a formula unit of copper(I) sulfite
(3) A formula unit of sodium sulfite contains as many sodium ions as a formula unit of sodium sulfate
(4) A formula unit of sodium sulfate contains more oxygen atoms than a formula unit of sodium sulfite
(5) None of the Above are false ☒

12. If volumes are additive and 80.0 mL of 0.40 M sodium chloride is mixed with 120 mL of a calcium chloride solution to give a new solution in which $[\text{Cl}^-]$ is 0.52 M, what is the concentration of the calcium chloride used to make the new solution?

- (1) 0.60 M **(2) 0.30 M** (3) 0.072 M (4) 0.036 M (5) 0.52 M

13. Chlorine gas is bubbled through a solution of bromide ions, resulting in the formation of liquid bromine, as follows:



During this reaction, which of the following occurs?

- (1) Chlorine (Cl_2) acts as the oxidizing agent**
(2) Chlorine (Cl_2) is oxidized to chloride ions
(3) Bromine (Br_2) acts as the reducing agent
(4) Bromide ion is reduced to bromine (Br_2)
(5) All of the above take place

14. How many atoms of oxygen are present in 8.00 grams of calcium perchlorate?

- (1) **1.613×10^{23}** (2) 1.613×10^{-23} (3) 8.85×10^{22} (4) 8.066×10^{22} (5) 1.210×10^{23}

15. Given the reaction: $3 \text{H}_2\text{S} + 2 \text{FeCl}_3 \rightarrow \text{Fe}_2\text{S}_3 + 6 \text{HCl}$

We have 50.0 g of FeCl_3 reacts with 52.0 g of H_2S . How much of the excess reactant is left over after reaction?

- (1) 15.758g **(2) 36.24g** (3) 105.98g (4) 0.462g (5) 52.0g

16. Phosphorus is obtained primarily from ores containing calcium phosphate. If a particular ore contains 55.1% calcium phosphate, what minimum mass of the ore must be processed to obtain 1.44 kg of phosphorus?

- (1) 30.97 g (2) 7.211 kg (3) 310.8 g **(4) 13.09 kg** (5) 23.25 g

17. A 5.00 M solution of dye is diluted by taking 10.00 ml of it and adding enough water to make 100.0 ml solution. Then, 20.00 ml of that solution is diluted to a volume of 250.0 ml. What is the concentration of the diluted dye?

- (1) 0.004 M
(2) **0.040 M**
(3) 0.400 M
(4) 0.020 M
(5) 0.002 M

18. The density of fresh milk is found to be 61.4 lb per cubic foot. Converted to SI units, this translates into:

- (1) 0.9825 kg/m³ (2) 983.6 kg/m³ (3) 895.2 kg/m³ (4) 0.8952 kg/m³ (5) 985.2 kg/m³

19. What is the percent yield of a reaction in which 232 g of phosphorus trichloride reacts with water to form 150 g of HCl and aqueous phosphorous acid (H₃PO₃)?

- (1) 18.8% (2) 41.0% (3) 59.0% (4) 100% (5) 81.2%

20. A chemist dilutes 35.3 ml of 6.15 M sodium chloride to make a 1.67 M solution. What is the final volume of the diluted solution?

- (1) 130.0 L
(2) 165.3 ml
(3) 165.3 L
(4) 130.0 ml
(5) 94.7 ml