

General Chemistry 1 (CHEM 1141)

Shawnee State University – Fall 2020

September 24, 2020

Exam # 1 A

Name KEY

*Please write your full name, and the exam version (1 A) that you have on the scantron sheet !
(Bubble in the best answer choice for each question on the green & white scantron sheet in pencil !)*

Please ☒ check the box next to your correct section number.

Section #: ☐ 1. (Monday Lab, 10:10 AM) ☐ 2. (Wednesday Lab, 10:10 AM)

 ☐ 3. (Monday Lab, 5:00 PM) ☐ 4. (Tuesday Lab, 11 AM)

 ☐ 5. (Thursday Lab, 11 AM)

Multiple Choice: _____ / 50

Q21: _____ / 10

Q22: _____ / 10

Q23: _____ / 10

Q24: _____ / 10

Q25: _____ / 10

BONUS: _____ / 3

TOTAL: _____ / 100

Each problem in this section (multiple choice) is worth 2.5 points !

Q1. Butter is an example of a(n):

- A) element
- B) compound
- C) homogeneous mixture
- D) heterogeneous mixture

2 or more components, variable ratio
same composition (homo) throughout

Q2. Using **SI prefixes**, the value: 0.000 023 mol can also be written as:

- A) 230 mmol
- B) 23 μ mol
- C) 2.3 nmol
- D) 0.23 pmol

$$23 \times 10^{-6} \text{ mol}$$
$$23 \mu \text{ mol}$$

Q3. An example of an **intensive** property is:

- A) mass
- B) chemical amount
- C) volume
- D) density

does not depend upon amount

Q4. A sample of mineral has a density of 2.84 g/cm³. What volume of this mineral would have a mass of 5.5 g?

- A) 0.52 mL
- B) 1.9 mL
- C) 2.7 mL
- D) 8.3 mL

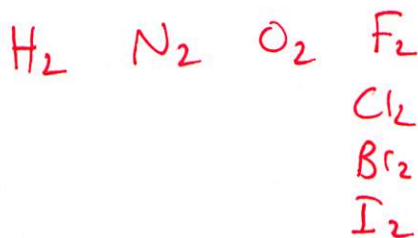
$$d = m/v, \quad v = m/d = \frac{5.5g}{2.84g/cm^3}$$
$$= 1.9 \text{ cm}^3 \text{ or mL}$$

same!

- Q5. How many significant figures does the measurement: 0.030 A have? x x ✓ ✓
- A) 1
 - B) 2
 - C) 3
 - D) 4
- Q6. Four students measured the volume of an object that should have been 5.25 mL. Which set of measurements were **inaccurate, yet precise**? close together
not close to ↑
- A) 5.90 mL, 3.10 mL, 10.00 mL
 - B) 5.25 mL, 5.29 mL, 5.45 mL
 - C) 5.24 mL, 5.34 mL, 5.17 mL
 - D) 5.10 mL, 5.09 mL, 5.11 mL
- Q7. Isotopes are atoms that:
- A) Contain more electrons than protons
 - B) Contain fewer electrons than protons
 - C) Contain the same number of protons as neutrons
 - D) Contain the same number of protons, but varying neutrons
- Q8. The element in the **fourth period** and **group 6A** is:
- A) Se
 - B) Hf
 - C) Pb
 - D) Cr
- Q9. Which pair of elements is likely to have similar chemical properties? same group
- A) Al & Ca
 - B) Sr & Rb
 - C) Mg & Al
 - D) Sr & Mg group 2A, alkaline earth metals

Q10. Which is NOT an example of a diatomic element?

- A) hydrogen
- B) nitrogen
- C) chlorine
- D) carbon



Q11. Which of the following substance's names does NOT begin with iron(II) ...

- A) Fe_2O_3 iron(III) oxide
- B) $FeSO_4$ iron(II) sulfate
- C) $Fe(OH)_2$ iron(II) hydroxide
- D) $Fe_3(PO_4)_2$ iron(II) phosphate

Q12. Which of the following substances is better known as sulfuric acid?

- A) $H_2S(aq)$
- B) $H_2SO_3(aq)$
- C) $H_2SO_4(aq)$
- D) $HSO_2(aq)$

Q13. Which of the following substances has a molar mass of 262.86 g/mol:

- A) $Ca(NO_3)_2$
- B) H_3PO_4
- C) $Mg_3(PO_4)_2$
- D) $ZnCl_2$

$$\begin{aligned} 3 \times Mg &= 3 \times 24.31 \\ 2 \times P &= 2 \times 30.97 \\ 8 \times O &= 8 \times 16.00 \\ \hline &262.87 \text{ g/mol} \end{aligned}$$

Q14. What is the percent by mass of oxygen in pyruvic acid, $C_3H_4O_3$?

- A) 16.0 %
- B) 30.4 %
- C) 48.0 %
- D) 54.5 %

$$\begin{aligned} 3 \times C &= 3 \times 12.01 \\ 4 \times H &= 4 \times 1.008 \\ 3 \times O &= 3 \times 16.00 \\ \hline &88.06 \text{ g/mol} \end{aligned}$$

$$\% O = \frac{3 \times 16.00 \text{ g/mol}}{88.06 \text{ g/mol}} \times 100 = 54.5\%$$

Q15. Calculate the atomic mass of element "X", if it has two naturally occurring isotopes with the following masses and natural abundances:

X-45 44.8776 amu 32.88%

X-47 46.9443 amu 67.12%

A) 46.26 amu

B) 45.91 amu

C) 46.34 amu

D) 46.84 amu

$$= 44.8776 \text{ u} \times \frac{32.88}{100} + 46.9443 \text{ u} \times \frac{67.12}{100}$$

Q16. A piece of metal ore weighs 9.25 g. When a student places it into a graduated cylinder containing water, the liquid level rises from 21.25 mL to 26.47 mL. What is the density of the ore?

A) 0.340 g/mL

B) 0.564 g/mL

C) 1.77 g/mL

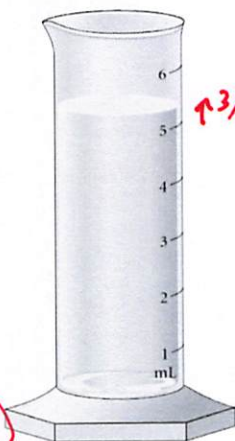
D) 2.94 g/mL

$$V_{\text{metal ore}} = 26.47 \text{ mL} - 21.25 \text{ mL} = 5.22 \text{ mL (2 d.p.)}$$

$$d = \frac{m}{V} = \frac{9.25 \text{ g}}{5.22 \text{ mL}} = 1.77 \text{ g/mL}$$

Q17. Read the water level with the correct number of significant figures.

A) 5 mL



B) 5.3 mL

C) 5.32 mL

D) 5.320 mL

$$5 \text{ mL} + \frac{3}{10} \times 1 \text{ mL} = 5.3 \text{ mL}$$

Q18. How many zinc atoms are contained in 3.75 moles of zinc?

A) 1.23×10^{24} zinc atoms

$$3.75 \text{ mol Zn} \times \frac{6.022 \times 10^{23} \text{ atoms Zn}}{1 \text{ mol Zn}}$$

$$= 2.26 \times 10^{24} \text{ atoms Zn}$$

B) 2.26×10^{24} zinc atoms

C) 2.26×10^{23} zinc atoms

D) 9.03×10^{24} zinc atoms

E) 6.50×10^{25} zinc atoms

1 mol atoms

Q19. Which of the following is equal to exactly Avogadro's number of atoms?

A) 8.00 grams of oxygen

B) 30.69 grams of nickel

C) 4.003 grams of helium

D) 11.99 grams of sodium

E) 35.00 grams of bromine

He is monatomic, so

He
4.003

atomic
mass

= mass (g) of
1 mol atoms

Q20. The correct answer (reported to the proper number of significant figures) to the following is:

$$7.3 \times 4.23 =$$

31

2sf.

✓✓✓
30.879

A) 31

B) 30.9

C) 1.7

D) 30.88



Each problem in this section (short answer) is worth 10 points !

All work must be shown in order to receive credit !

You must use the factor-label (conversion-factor) method for all conversions !

Be sure to include units where applicable !

All numeric answers must be rounded to the correct number of significant figures !



- Q21. (A) Using the conversion-factor method, convert a density of 808 lb/ft^3 to g/cm^3 .
Hint: $1 \text{ lb} = 453.6 \text{ g}$, $1 \text{ ft} = 12 \text{ in}$, $1 \text{ in} = 2.54 \text{ cm}$

$$\frac{808 \text{ lb}}{\text{ft}^3} \times \left(\frac{1 \text{ ft}}{12 \text{ in}} \right)^3 \times \left(\frac{1 \text{ in}}{2.54 \text{ cm}} \right)^3 \times \frac{453.6 \text{ g}}{1 \text{ lb}} = 12.9 \text{ g/cm}^3$$

- (B) What volume would 23.10 g of this sample occupy?

$$d = \frac{m}{V}, \quad V = \frac{m}{d} = \frac{23.10 \text{ g}}{12.9 \text{ g/cm}^3} = 1.79 \text{ cm}^3 \quad (3 \text{ s.f.})$$

4 s.f. (above 23.10)
3 s.f. (below 12.9)

Q22. How many protons, neutrons, and electrons do the following contain:

A) an **atom** of chlorine-38, $^{38}_{17}\text{Cl}$ p: 17 n: 21 e: 17 #p⁺ - charge

B) an **ion** of aluminum-27 $^{27}_{13}\text{Al}^{3+}$ p: 13 n: 14 e: 10

C) an **ion** of sulfur-30 $^{30}_{16}\text{S}^{2-}$ p: 16 n: 14 e: 18
atomic # mass # - atomic #

Note: for the **ions**, be sure to use the **correct charge** that the ion forms!

Q23. (A) How many (#) **atoms of neon, Ne(g)**, are contained in a 14.0 g sample of neon?

$$14.0\text{g Ne} \times \frac{1\text{mol Ne}}{20.18\text{g Ne}} \times \frac{6.022 \times 10^{23} \text{ atoms Ne}}{1\text{mol Ne}} = 4.18 \times 10^{23} \text{ atoms Ne}$$

(B) How many (#) **molecules of H₂O(g)**, are contained in a 14.0 g sample of water?

$$14.0\text{g H}_2\text{O} \times \frac{1\text{mol H}_2\text{O}}{18.02\text{g H}_2\text{O}} \times \frac{6.022 \times 10^{23} \text{ molec. H}_2\text{O}}{1\text{mol H}_2\text{O}} = 4.68 \times 10^{23} \text{ molecules H}_2\text{O}$$

$2 \times \text{H} + 1 \times \text{O} = 2 \times 1.008 + 16.00 = 18.02\text{g/mol}$

(C) How many (#) **atoms of hydrogen** are contained in a 14.0 g sample of water?

$$14.0\text{g H}_2\text{O} \times \frac{1\text{mol H}_2\text{O}}{18.02\text{g H}_2\text{O}} \times \frac{6.022 \times 10^{23} \text{ molec. H}_2\text{O}}{1\text{mol H}_2\text{O}} \times \frac{2 \text{ atoms H}}{1 \text{ molec. H}_2\text{O}} = 9.36 \times 10^{23} \text{ atoms H}$$

Q24. Provide names for the following substances:

A) $\text{CaSO}_3 \cdot 2\text{H}_2\text{O}$ calcium sulfite dihydrate

B) N_3Cl_7 trinitrogen heptachloride

C) $\text{Fe}(\text{NO}_2)_2$ iron(II) nitrite

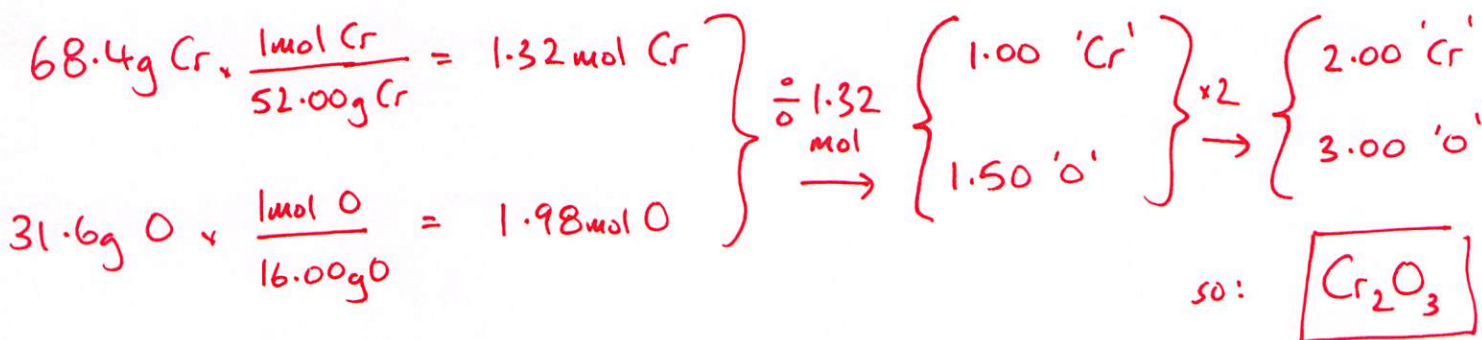
D) $\text{Cu}(\text{HCO}_3)_2$ copper(II) bicarbonate

E) Br_2N_9 dibromine nonanitride

Q25. An ionic compound is found to contain 68.4 % chromium (Cr) by mass and 31.6 % oxygen by mass.

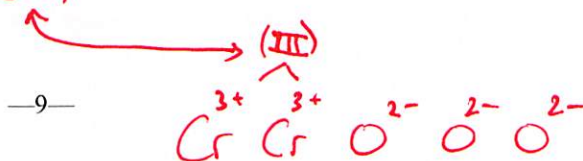
(A) determine its empirical formula:

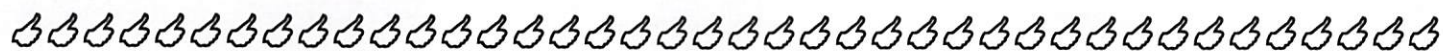
Assume 100-g



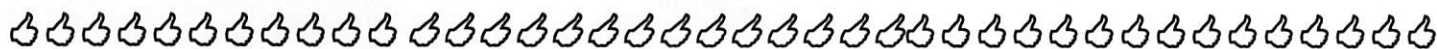
(B) what is the systematic name given to this substance?

chromium(III) oxide





3 Point Bonus Question



Calculate to the correct number of digits (and units) the expression:

$$\frac{103.20 \text{ g} - 101.10 \text{ g}}{0.03200 \text{ mL}} = \frac{2.10 \text{ g} - 2 \text{ dp}}{0.03200 \text{ mL}} \text{ (sub)} = \frac{2.10 \text{ g} - 3 \text{ s.f.}}{0.03200 \text{ mL}} \text{ (div)} = 65.6 \text{ g/mL (3 s.f.)}$$

4 sf

Exam checklist:

(Check the boxes to certify the following:)

- ☒ My full name is written legibly on the front page
- ☒ My correct lab section has been indicated on the front page
- ☒ My full name is written legibly on the scantron sheet
- ☒ My exam version (A, B, C, or D) is written on the scantron sheet
- ☒ I have shown work for all problems (where appropriate), paying attention to
 - ☒ Significant figures / decimal places
 - ☒ Units
- ☒ I have used the conversion-factor method for all conversions
- ☒ If I have torn off the back page (periodic table), I will not turn it in with my exam!

Thank-you from the Chemistry Professors and Good Luck!



Useful information:

N_A = 6.022 × 10²³ mol⁻¹

Periodic Table of the Elements																				
IA	IIA												IIIA	IVA	VA	VIA	VIIA	VIIIA		
1	2												13	14	15	16	17	18		
1 H 1.008	2 He 4.003												5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18		
11 Na 22.99	12 Mg 24.31												13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95		
19 K 39.10	20 Ca 40.08	21 Sc 44.96		22 Ti 47.87	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.61	33 As 74.92	34 Se 78.96	35 Br 79.90			
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc [98]	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.60	53 I 126.9	54 Xe 131.3			
55 Cs 132.9	56 Ba* 137.3	57 Lu 175.0	58 Hf 178.5	59 Ta 180.9	60 W 183.8	61 Re 186.2	62 Os 190.2	63 Ir 192.2	64 Pt 195.1	65 Au 197.0	66 Hg 200.6	67 Tl 204.4	68 Pb 207.2	69 Bi 209.0	70 Po [210]	71 At [210]	72 Rn [222]			
87 Fr [223]	88 Ra** [226]	89 La 138.9	90 Ce 140.1	91 Pr 140.9	92 Nd 144.2	93 Pm [145]	94 Sm 150.4	95 Eu 152.0	96 Gd 157.3	97 Tb 158.9	98 Dy 162.50	99 Ho 164.9	100 Er 167.3	101 Tm 168.9	102 Yb 173.0	103 Lu 174.967	104 Be 9.0122			