

Pay attention to significant figures in all calculations!

	IA (1)																	VIIIA (18)	
1	1 H 1.0080																		2 He 4.0026
		IIA (2)										III A (13)	IV A (14)	V A (15)	VIA (16)	VII A (17)			
2	3 Li 6.9410	4 Be 9.0122										5 B 10.811	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.998	10 Ne 20.179		
3	11 Na 22.990	12 Mg 24.305	IIIB (3)	IVB (4)	VB (5)	VIB (6)	VII B (7)	VIII B (8)	VIII B (9)	VIII B (10)	IB (11)	IIB (12)	13 Al 26.982	14 Si 28.086	15 P 30.974	16 S 32.066	17 Cl 35.453	18 Ar 39.948	
4	19 K 39.098	20 Ca 40.078	21 Sc 44.956	22 Ti 47.880	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.847	27 Co 58.933	28 Ni 58.690	29 Cu 63.546	30 Zn 65.380	31 Ga 69.723	32 Ge 72.610	33 As 74.922	34 Se 78.960	35 Br 79.904	36 Kr 83.800	
5	37 Rb 85.468	38 Sr 87.620	39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.940	43 Tc 98.907	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.75	52 Te 127.60	53 I 126.90	54 Xe 131.29	
6	55 Cs 132.91	56 Ba 137.33	57 La 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.85	75 Re 186.21	76 Os 190.20	77 Ir 192.22	78 Pt 195.09	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.20	83 Bi 208.98	84 Po 208.98	85 At 209.99	86 Rn 222.02	
7	87 Fr 223.02	88 Ra 226.03	89 Ac 227.03	104 Unq 261.11	105 Unp 262.11	106 Unh 263.12	107 Uns 262.12												

- (2 points) One atom of $^{195}\text{Pt}^{3+}$ contains 78 protons, 117 neutrons, and 75 electrons.
- (10 points) Complete the following table of compound (or ion) names and formulas.

Formula	Name
MgO ₂	magnesium peroxide
S ₂ O ₃ ²⁻	thiosulfate ion
Cr ₂ O ₇ ²⁻	dichromate ion
K ₃ PO ₄	potassium phosphate
Na ₂ C ₂ O ₄	sodium oxalate
ammonium nitrite	ammonium nitrite
ClO ₄ ⁻	perchlorate ion
Al ₂ (CO ₃) ₃	aluminum carbonate
Hg ₂ SO ₄	mercury(I) sulfate
N ₃ ⁻	azide ion

3. Dr. Bob's daughter has a cat named Osmium. The element osmium (Os) is an extremely durable metal that has some specialized applications in microelectronics. It is the most dense, naturally occurring element. (*Note*: The following questions about osmium can be answered independently! Also, you must use the mole concept to receive any credit for part b!)

- (a) (4 points) **SHOW ALL WORK.** A tiny block of Os, weighing only 283 ng, is 5.00 mm long, 2.50 μm wide, and 1.00 μm thick. Determine the density of osmium (the element, not the cat!) in g/cm^3 .

$$L = (5.00 \text{ mm}) (10^{-3} \text{ m} / 1 \text{ mm}) (1 \text{ cm} / 10^{-2} \text{ m}) = 0.500 \text{ cm}$$

$$W = (2.50 \mu\text{m}) (10^{-6} \text{ m} / 1 \mu\text{m}) (1 \text{ cm} / 10^{-2} \text{ m}) = 2.50 \times 10^{-4} \text{ cm}$$

$$T = (1.00 \mu\text{m}) (10^{-6} \text{ m} / 1 \mu\text{m}) (1 \text{ cm} / 10^{-2} \text{ m}) = 1.00 \times 10^{-4} \text{ cm}$$

$$V = LWT = (0.500 \text{ cm}) (2.50 \times 10^{-4} \text{ cm}) (1.00 \times 10^{-4} \text{ cm}) = 1.25 \times 10^{-8} \text{ cm}^3$$

$$d = \text{mass}/V = (283 \times 10^{-9} \text{ g}) / (1.25 \times 10^{-8} \text{ cm}^3) = 22.6 \text{ g}/\text{cm}^3$$

- (b) (4 points) **SHOW ALL WORK.** Determine the number of atoms in the 283-ng block of Os.

$$\begin{aligned} &(283 \times 10^{-9} \text{ g}) (1 \text{ mole Os} / 190.20 \text{ g}) (6.022 \times 10^{23} \text{ atoms/mole}) \\ &= 8.96 \times 10^{14} \text{ atoms} \end{aligned}$$

4. (5 points) **SHOW ALL WORK.** Copper (Cu) has two naturally occurring isotopes: ^{63}Cu and ^{65}Cu . The ^{63}Cu isotope has a natural abundance of 69.17 %. The ratio of the masses of the two isotopes is 1.0317. Determine the mass of the ^{63}Cu isotope in amu.

$$\text{atomic mass of Cu} = 63.546 \text{ amu} = \text{weighted average of isotope masses}$$

$$\text{let } x = \text{mass of } ^{63}\text{C}$$

$$63.546 \text{ amu} = (0.6917) (x) + (0.3083) (1.0317 x)$$

$$x = 62.931 \text{ amu}$$