Chem 30A — Fossum

Review Problems for exam 1 — p. 1

1. a. 5.87×10^{4} c. 3.35×10^{3}
   b. 8.40×10^{-2} d. 2.2×10^{-4}
2. a. 0.0000000822 c. 479
   b. 749300 d. 0.009637
3. a.) 2500 mL — 2 sf, ± 100 mL, 2400–2600 mL
   b.) 0.0035 g — 2 sf, ± 0.0001 g, 0.0034–0.0036 g
   c.) 0.834 g — 3 sf, ± 0.001 g, 0.833–0.835 g
   d) 400 m — 1 sf, ± 100 m, 300–500 m
   e) 10.00 mL — 4 sf, ± 0.01 mL, 9.99–10.01 mL
   f) 10. g — 2 sf, ± 1 g, 9–11 g
4. a. $22 + 273 = 295$ K
   b. $°C = \frac{(°F-32)}{1.8} = \frac{(73-32)}{1.8} = 22.78\ °C = 23\ °C$
   c. 353 K to °C $353 - 273 = 80.°C$
   d. 42°C to °F $°F = 1.8(42) + 32 = 107.6°F = 108°F$
5. a. $(43\ cg)\left(\frac{1\ g}{100\ cg}\right) = 0.43\ g$
   b. $(52.0\ cm)\left(\frac{1\ in}{2.54\ cm}\right) = 20.472\ in = 20.5\ in$
   c. $(78\ \mu m)\left(\frac{1\ m}{10^{6}\ \mu m}\right) = 7.8 \times 10^{-5}\ m$
   d. $(92.0\ mL)\left(\frac{1\ L}{1000\ mL}\right) = 0.092\ L$
6. a. 45 in → mm $1\ in = 2.54\ cm$ $100\ cm = 1\ m$ $1000\ mm = 1\ m$
   $(45\ in)\left(\frac{2.54\ cm}{1\ in}\right)\left(\frac{1\ m}{100\ cm}\right)\left(\frac{1000\ mm}{1\ m}\right) = 1143\ mm$
   $= 1100\ mm$ (2 sf) → or $1.1 \times 10^{3}\ mm$

   b. 56.0 µL → gal $(1\ L = 10^{6}\ \mu L)$
   $(56.0\ \mu L)\left(\frac{1\ L}{10^{6}\ \mu L}\right)\left(\frac{1\ qt}{0.94635\ L}\right)\left(\frac{1\ gal}{4\ qt}\right) = 1.48 \times 10^{-5}\ gal$

6c. $200\ g \rightarrow$ tons

$$(200\ g)\left(\frac{1\ lb}{453.6\ g}\right)\left(\frac{1\ ton}{2000\ lb}\right) = \bar{2}.2 \times 10^{-4}\ tons$$

2×10^{-4} tons

d. $76.3\ cm \rightarrow ft$

$$(76.3\ cm)\left(\frac{1\ in}{2.54\ cm}\right)\left(\frac{1\ ft}{12\ in}\right) = 2.50\ ft$$

7. a. physical b. chemical c. physical

8. $21.7\ mL - 12.2\ mL = 9.5\ mL = V$ of object

$$d = \frac{m}{V} = \frac{71.53\ g}{9.5\ mL} = 7.5\ g/mL \quad (2sf)$$

9. $\frac{1.40\ g}{1\ cm^3}$

$$(350\ mg)\left(\frac{1\ g}{1000\ mg}\right)\left(\frac{1\ cm^3}{1.40\ g}\right) = 0.25\ cm^3$$

10. $V = l \times w \times h = (0.82\ cm)(1.45\ cm)(1.25\ cm) = 1.\bar{4}8625\ cm^3$ (2sf)

$$d = \frac{m}{V} = \frac{0.794\ g}{1.\bar{4}8625\ cm^3} = 0.5\bar{3}42\ g/cm^3 = 0.53\ g/cm^3$$

11. $\frac{1.1088\ g}{1\ mL}$

a. $$(2.00\ L)\left(\frac{1000\ mL}{1\ L}\right)\left(\frac{1.1088\ g}{1\ mL}\right) = 22\bar{1}7.6\ g \quad 3sf$$

or $2220\ g$ or $2.22 \times 10^3\ g$

b. $$(2.00\ lb)\left(\frac{453.6\ g}{1\ lb}\right)\left(\frac{1\ mL}{1.1088\ g}\right)\left(\frac{1\ L}{1000\ mL}\right)\left(\frac{1\ qt}{0.946\bar{3}5\ L}\right) =$$

$$= 0.86\bar{4}565\ qt$$

$$= 0.865\ qt$$

12. $\frac{25\text{ m}}{1\text{ sec}} \rightarrow \frac{\text{miles}}{\text{hr}}$

$$\left(\frac{25\text{ m}}{1\text{ sec}}\right)\left(\frac{1\text{ km}}{1000\text{ m}}\right)\left(\frac{0.62137\text{ mi}}{1\text{ km}}\right)\left(\frac{60\text{ sec}}{1\text{ min}}\right)\left(\frac{60\text{ min}}{1\text{ hr}}\right) = 55.92\frac{\text{M}}{\text{hr}}$$

$$= 56\text{ miles/hr}$$

13. $q = smT$ $\quad \Delta T = 100.0 - 19.3 = 80.7\,^\circ C$

$$q = \left(1.00\frac{\text{cal}}{\text{g}^\circ\text{C}}\right)(150.0\text{ g})(80.7\,^\circ C) = 12105\text{ cal}$$

$$= 1.21 \times 10^4\text{ cal} \quad \text{or} \quad 12100\text{ cal}$$

Note $S = C$ heat capacity (specific heat)

14. $\frac{q}{s\Delta T} = \frac{smT}{s\Delta T}$ $\quad 256\text{ J}$ (↑ need to convert) $\quad 0.21\text{ cal/g}^\circ\text{C}$ $\quad \Delta T = 43.7 - 22.3$, $\Delta T = 21.4\,^\circ C$

$$(256\text{ J})\left(\frac{1\text{ cal}}{4.184\text{ J}}\right) = 61.185\text{ cal}$$

$$m = \frac{q}{s\Delta T} = \frac{61.185\text{ cal}}{\left(0.21\frac{\text{cal}}{\text{g}^\circ\text{C}}\right)(21.4\,^\circ C)} = 13.615\text{ g} = 14\text{ g}$$

2 sf

15. 2.00 kJ $\quad 35.0\text{ g}$ $\quad T_i = 21.0\,^\circ C$ $\quad T_f\,?$

$s = 4.184\text{ J/g}^\circ\text{C}$

$$(2.00\text{ kJ})\left(\frac{1000\text{ J}}{1\text{ kJ}}\right) = 2000\text{ J}$$

3 sf

$\frac{q}{sm} = \frac{smT}{sm}$ $\quad$ find ΔT

$$\Delta T = \frac{q}{sm} = \frac{2000\text{ J}}{\left(4.184\frac{\text{J}}{\text{g}^\circ\text{C}}\right)(35.0\text{ g})} = 13.657\,^\circ C = \Delta T$$

final T: $\quad 21.0\,^\circ C + 13.657\,^\circ C = 34.657\,^\circ C$

$= 34.7\,^\circ C$ final T

16. 4.99 kJ (→ convert to J) 1.03 kg (→ convert to g) $\Delta T = 32.1 - 21.9 = 10.2°C$

find C in J/g°C $\quad q = C m \Delta T$

$C = \frac{q}{m\Delta T}$

$(4.99\ kJ)\left(\frac{1000\ J}{1\ kJ}\right) = 4990\ J$

$(1.03\ kg)\left(\frac{1000\ g}{1\ kg}\right) = 1030\ g$

$C = \frac{4990\ J}{(1030\ g)(10.2°C)} = 0.475\ J/g°C$

17. $\frac{5.4\ mg\ med}{1\ kg\ body}$ $\quad$ $\frac{200\ mg\ med}{1\ mL\ solution}$

$(150\ lb)\left(\frac{1\ kg\ body}{2.205\ lb}\right)\left(\frac{5.4\ mg\ med}{1\ kg\ body}\right)\left(\frac{1\ mL\ solution}{200\ mg\ med}\right) = 1.84 mL$

3sf $\quad$ 4sf $\quad$ 2sf $\quad$ 1sf

round to 2 mL solution

18. a. $5.9 \times 89.44 = 527.696 = \cancel{52}\ 530$ or 5.3×10^2 (2sf)

2sf $\quad$ 4sf $\quad$ 2sf

b. $21.793 - 0.0563 = 21.7367 = 21.737$

3 dec places $\quad$ 4 dec places $\Rightarrow$ 3 dec places

c. $0.0467 \times 66 = 3.0822 = 3.1$

3sf $\quad$ 2sf $\quad$ 2sf

d. $1780 + 3500 + 21.77 = 5301.77 = 5300$ or 5.3×10^3

$\pm 10 \quad \pm 100 \quad \pm 0.01 \quad \pm 100$

e. $\frac{(4.332 - 3.92)}{2.800} = \frac{(0.412)}{2.800} = \frac{0.412}{2.800} = 0.14714 = 0.15$ (2sf)

3 dec places $\quad$ 2 dec places $\quad$ 4sf

18 f. $(9.78 \times 4.46) + 25.88 = 43.6188 + 25.88 = 69.4988$

(3sf and 3sf; 3sf and 1 dec place; 2 dec places; 1 dec place)

69.5

19. a. $72\ in^3 \rightarrow cm^3$ use $1\ in = 2.54\ cm$ (exact)

$$72\ in^3 \left(\frac{2.54\ cm}{1\ in}\right)^3 = 1179.9\ cm^3 = 1.2 \times 10^3\ cm^3 \text{ or } 1200\ cm^3$$

a cubic inch is a bigger unit than a cubic centimeter. There should be more cubic centimeters than cubic inches - so # cm^3 should be higher than # in^3 - and it is.

b.
$$(1500\ ft^2)\left(\frac{12\ in}{1\ ft}\right)^2\left(\frac{2.54\ cm}{1\ in}\right)^2\left(\frac{1\ m}{100\ cm}\right)^2 = 139.35\ m^2$$

140 square meters (2sf)

a foot is smaller than a meter. Square meters is a larger unit than square feet - there should be fewer square meters compared to square feet.

20. need ... $\frac{km}{L}$

$\frac{42}{1}\ \frac{mi}{gal}$ so $\left(\frac{42\ mi}{1\ gal}\right)\left(\frac{1\ km}{0.62137\ mi}\right)\left(\frac{1\ gal}{4\ qt}\right)\left(\frac{1\ qt}{0.94635\ L}\right) = 18\ \frac{km}{L}$

21. ^{79}Br ^{81}Br Look at periodic table. Atomic mass of Br is 79.90 amu. This is closer to 79 than it is to 81. The abundance of ^{79}Br must be higher than the abundance of ^{81}Br.

22. a. Co 27 p^+ 27 + 33 = 60 mass number $^{60}_{27}Co$

b. 201 Hg 80 p^+, 80 e^- 201 − 80 = 121 neutrons

23. wt. ave atomic mass = (mass A)(abundance A) + (mass B)(abundance B) + ...

use decimal abundances.

wt. ave mass = (6.01512 amu)(0.075) + (7.01600 amu)(0.925)
(6 sf) (2 sf) (6 sf) (3 sf)

wt. ave mass = 0.451134 amu + 6.4898 amu
(2 sf) (3 sf)

wt ave mass = 0.451134 amu = 6.4898 amu = 6.940934 amu
(2 dp) (2 dp) (2 dec places)

6.94 amu

24. wt ave mass Ni = (0.6827)(57.9353 amu) + (0.2610)(59.9308 amu) + (0.0113)(60.9310 amu) + (0.0359)(61.9283 amu) + (0.0091)(63.9280 amu)
(4 sf) (6 sf) (4 sf) (6 sf) (3 sf) (6 sp) (3 sf) (6 sf) (2 sf) (6 sf)

wt ave mass Ni = 39.5524 amu + 15.6419 amu + 0.68852 amu + 2.2232 amu + 0.5817 amu
(2 dp) (2 dp) (3 dp) (2 dp) (2 dp)

wt ave mass = 58.68772 amu = 58.69 amu
(2 dec places)

25. $\frac{?\ mg\ med}{kg\ body}$ find # mg medication, find # kg body, divide.

$(140\ lb)\left(\frac{1\ kg}{2.205\ lb}\right) = 63.492\ kg$

$3 \times 250\ mg = 750\ mg\ med$

$\frac{750\ mg\ med}{63.492\ kg\ body} = \frac{11.8\ mg\ med}{1\ kg}$ or 12 mg/kg

25b. 50 lb child Same dosage $\frac{11.8\ mg\ med}{kg\ body}$

tablets are 150 mg each,

so $\frac{150\ mg}{1\ tablet}$ lb → kg body → mg med → tablets

$$(50\ lb_{body})\left(\frac{1\ kg\ body}{2.205\ lb}\right)\left(\frac{11.8\ mg\ med}{1\ kg\ body}\right)\left(\frac{1\ tablet}{150\ mg}\right) = 1.78\ tablets$$

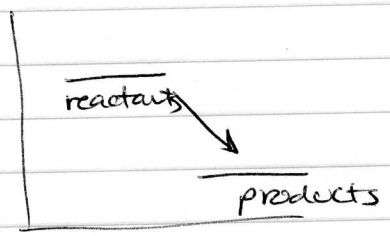
round to = 2 tablets

27. Charges:

F group 7A, so ion is −1 charged. F^-

Ca	2A	+2	Ca^{2+}
Na	1A	+1	Na^+
O	6A	−2	O^{2-}

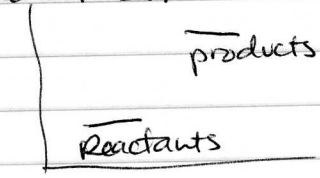
28. Exothermic



heat given off.

products are lower energy and more stable than reactants.

endothermic



heat absorbed

reactants have lower energy and are more stable than products.

29. 200 Cal 1 Cal = 1 kcal

$$(200\ Cal)\left(\frac{1\ kcal}{1\ Cal}\right)\left(\frac{1000\ cal}{1\ kcal}\right)\left(\frac{4.184\ J}{1\ cal}\right)\left(\frac{1\ kwh}{3.60\times10^6\ J}\right) = 0.232\ kwh$$

1sf

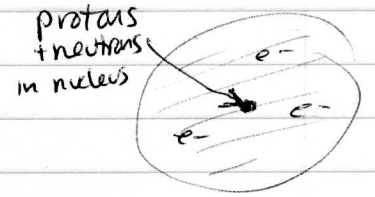
= 0.2 kwh

1sf

30. S Sulfur - group 6A, period 3, nonmetal, main-group
He helium group 8A, period 1, noble gas, nonmetal, main-group
Mg magnesium group 2A, period 3, alkaline earth metal, metal, main-group
Cu copper - group 1B, period 4, metal, transition metal
B boran group 3A, period 2, metalloid, main-group.

31.

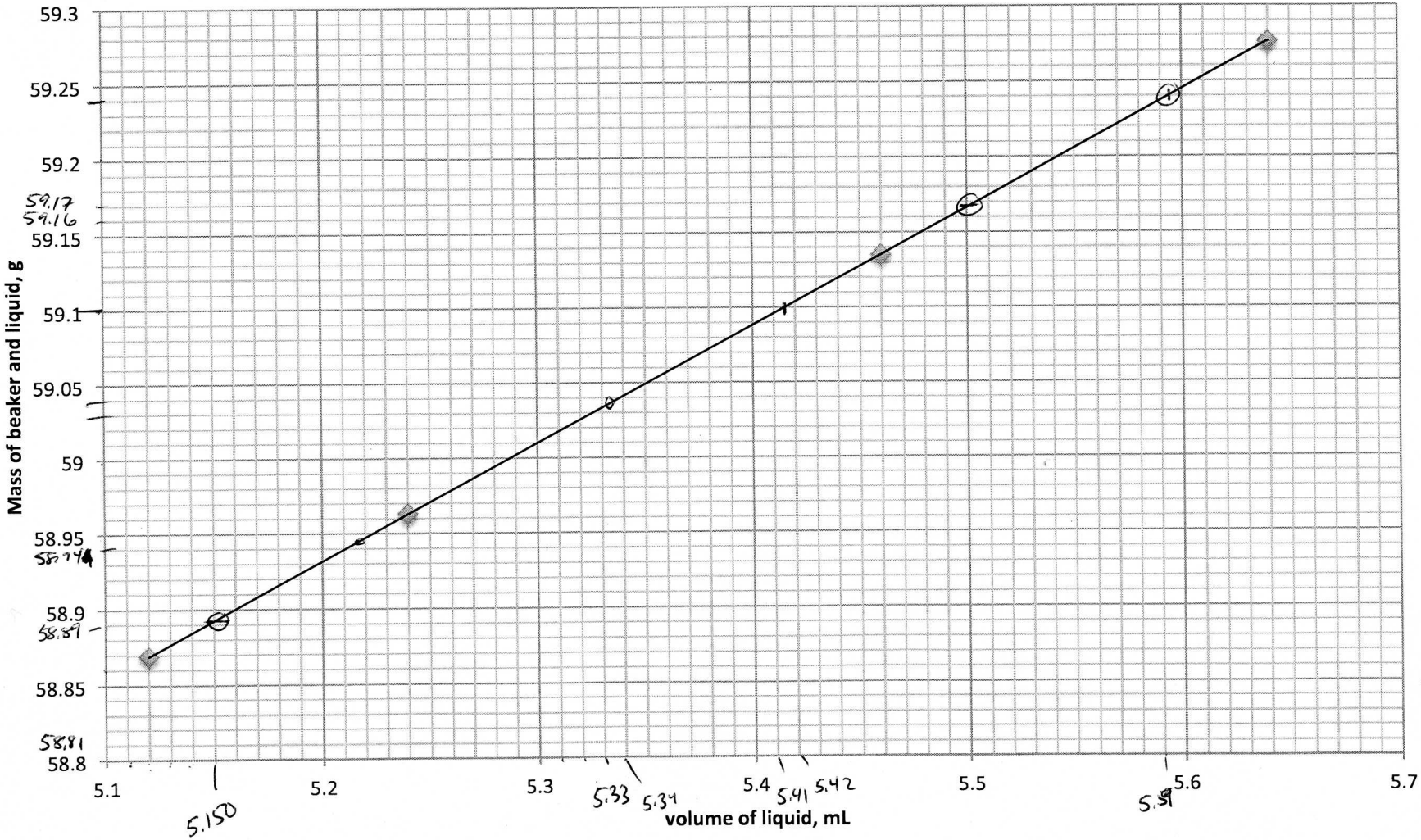
protons: +1, 1amu) in nucleus
neutrons ø, 1 amu)
electrons -1 (very small) amu) outside nucleus



32. a. 5.150mL → 58.892 or 58.893 g
b. 5.500mL → 59.168 or 59.167 g
c. 59.100 g → 5.415 mL
d. 59.240 g → 5.594 or 5.595 mL
e. 5.334 mL → 59.036 or 59.035 or 59.037 g
f. 58.946 g → 5.217 or 5.216 mL

each division on y axis equals 0.01 g estimate to ± 0.001 g (3 digits after decimal)

Mass of beaker and liquid vs. volume of liquid



each division along the ~~x~~ y axis is 0.01 mL, estimate to ± 0.001 mL (3 digits after decimal)

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