1.

a) original

a = 4.17x10^-7 L/cm^3

b = 0.045 L/kg

c = -0.03 L

$$a = \frac{4.17\text{x}10\text{^-}7\ \text{L}}{\text{cm\^{}3}} \quad \frac{2.11\ \text{pint}}{\text{L}} \quad \frac{(2.54\ \text{cm})\text{\^{}3}}{\text{in\^{}3}} \quad \frac{(12\ \text{in})\text{\^{}3}}{\text{ft\^{}3}} = 2.5\text{X}10\text{\^{}-2 pt/ft\^{}3}$$

$$b = \frac{0.045\ \text{L}}{\text{kg}} \quad \frac{2.11\ \text{pint}}{\text{L}} \quad \frac{0.4536\ \text{kg}}{\text{lbm}} = 4.3\text{x}10\text{\^{}-2}\ \frac{\text{pint}}{\text{lbm}}$$

c = (-0.03 L) (2.11 pint/L)= -6x10^-2 pint

b) $V_{blood} = (2.5 \times 10^{-2}\ \text{pt/ft}^3)(6.08\ \text{ft})^3 + (4.3\text{x}10^{-2}\ \text{pt/lbm})(215\ \text{lbm}) – 6\text{x}10^{-2}\ \text{pt}$

$= 14.80$ pint

% = (change in volume)/(volume) = (1 pt)/(14.8) = 0.0675 = **6.8%**

note that (73 inches)(1 ft / 12 inches) = 6.08 ft

(see next page for 1c)

1c

Conversions for feet:

Height

$5.71\text{ ft} \times \frac{12\text{ inch}}{1\text{ ft}} \times \frac{2.54\text{ cm}}{1\text{ inch}} \approx 174\text{ cm}$

Mass:

$172\text{ lbm} \times \frac{.4536\text{ kg}}{1\text{ lbm}} = 78.0192\text{ kg}$

stand. deviations

$25\text{ ft} \times \frac{12\text{ in}}{1\text{ ft}} \times \frac{2.54\text{ cm}}{1\text{ inch}} = 7.62\text{ cm}$

$15\text{ lbm} \times \frac{.4536\text{ kg}}{1\text{ lbm}} = 6.804\text{ kg}$

$$\rightarrow \bullet\ \bar{V}(L) = aH^3 + bM + c$$
$$= (4.17\times10^{-7})(174\text{ cm})^3 + (.045)(78.0192) - .032$$
$$= 5.68\text{ L}$$

$$\rightarrow \bullet\ s^2(V) = \left(\frac{\partial V}{\partial H}\right)^2_{\bar{H},\bar{M}} s^2(H) + \left(\frac{\partial V}{\partial M}\right)^2_{\bar{H},\bar{M}} s^2(M)$$

Note:

$\frac{\partial V}{\partial H} = 3aH^2$

$\frac{\partial V}{\partial M} = b$

$$= (3aH^2)^2 s^2(H) + (b)^2 s^2(M)$$
$$= [3(4.17\times10^{-7})(174\text{ cm})^2]^2 (7.62\text{ cm})^2 + [(.045)^2 (6.804)^2]$$
$$= .09374$$
$$s(V) = \sqrt{.09374} = .30617$$

$$\rightarrow\ 95\%\ \text{limit} = t(df\,(N_x - 1 + N_y - 1, 95\%) \cdot s(V) \Big/ \sqrt{\frac{N_x * N_y}{N_x + N_y}}$$

$$= \frac{t(34+16, 95\%) \cdot s(v)}{\sqrt{\frac{(35)(17)}{(35+17)}}}$$

$$= \frac{t(50, 95\%)(.30617)}{3.38265}$$

$$= \frac{(1.96)(.3016)}{3.38265}$$

$$= .1747\ L$$

Total Answer $5.68 \pm .1747\ L$

Main Analysis of failure:

1. Data not linked. The data was sampled from 2 different groups. All the data needs to be consistent in its sampling group. The height and weight should be taken from the same group.

2.

$$\frac{200 \text{ prot}}{\text{cell}} \quad \frac{75 \text{ AA}}{\text{prot}} \quad \frac{3 \text{ bases}}{\text{AA}} = \mathbf{4.5x10^{\wedge}4 \text{ bases/cell}}$$

3. # bases$^{(\text{\# bases in a codon})}$ = AA

$5^x = 25$

x = 2…… BUT… **we need a stop codon and we have reached the most AA we can code with 2, so we need 3 bases per codon to fully code this**.

4. $$70 \text{ kg wet} \quad \frac{30 \text{ kg dry}}{100 \text{ kg wet}} \quad \frac{60 \text{ kg prot}}{100 \text{ kg dry}} = 12.6 \text{ kg prot}$$

$$12.6\text{kg prot} \quad \frac{1000 \text{ g}}{1 \text{ kg}} \quad \frac{1 \text{ mol prot}}{100 \text{ molAA}} \quad \frac{1 \text{ mol AA}}{100 \text{ g}} \quad \frac{6.02\text{x}10^{\wedge}23 \text{ molec}}{1 \text{ mol prot}} \quad \frac{10^{\wedge}\text{-}8 \text{ cm}}{1 \text{ molec}} \quad \frac{1 \text{ m}}{100 \text{ cm}}$$

= 7.59x10^13 m

DISTANCE

2450 miles(1609.334m/mile) = 3.94x10^7 m < 7.59x10^13 **This protein can cover the distance from Pittsburgh to LA.**

5.
To solve this problem we assume that each gene is responsible for one protein.

(a) (1000 genes) * (10 genes/100 genes) * (100 AA/prot) * (1 prot/gene) * (3bases/AA) =
= **30,000 bases expressed**
(b) (1000 genes) * (1 prot/gene) * (100 AA/prot) * (3 bases/AA) = **300,000 bases total**

6.
We obtain the amino acid sequence of EMP1 from the first provided website (Johnson et al.). The sequence is GGTY SCHF GPLT WVCK PQGG.

Using the figure on page 1.48 of the "Topic 1" lecture notes, we can decode the amino acid sequence into a nucleotide sequence. However, some of the amino acids correspond to multiple codons, so we use the second website (provided in the problem) to find the most frequently used codons. For example, the amino acid G (Glycine) is coded by GGA, GGC, GGU, and GGG. However, we see from the usage table that GGU is the most commonly used of these four codons. Thus, we get the best putative nucleotide sequence:

GGU GGU ACU UAU UCU UGU CAU UUU GGU CCA UUG ACU ...
... UGG GUU UGU AAA CCA CAA GGU GGU