Math Review -- KEY

Algebra:

1) $K = C + 273.15$ (solve for C)

(subtract **273.15** from both sides) $K - 273.15 = C + 273.15 - 273.15 \rightarrow K - 273.15 = C$

2) $P \times V = n \times R \times T$ (solve for R)

(divide both sides by **T**) $\frac{P \times V}{T} = \frac{n \times R \times \cancel{T}}{\cancel{T}} \rightarrow \frac{P \times V}{T} = n \times R$

(divide both sides by **n**) $\frac{P \times V}{T \times n} = \frac{\cancel{n} \times R}{\cancel{n}} \rightarrow \frac{P \times V}{T \times n} = R$

3) $P \times V = n \times R \times T$ (solve for V)

(divide both sides by **P**) $\frac{\cancel{P} \times V}{\cancel{P}} = \frac{n \times R \times T}{P} \rightarrow V = \frac{n \times R \times T}{P}$

4) $\frac{67w - y + 3}{6} = 2z$ (solve for w)

(multiply both sides by **6**) $\frac{\cancel{6} \times 67w - y + 3}{\cancel{6}} = 2z \times 6 \rightarrow 67w - y + 3 = 12z$

(subtract **3** from both sides) $67w - y + 3 - 3 = 12z - 3 \rightarrow 67w - y = 12z - 3$

(add **y** to both sides) $67w - y + y = 12z - 3 + y \rightarrow 67w = 12z - 3 + y$

(divide both sides by **67**) $\frac{\cancel{67}\, w}{\cancel{67}} = \frac{12z - 3 + y}{67} \rightarrow w = \frac{12z - 3 + y}{67}$

5) $C = \frac{(F - 32)}{1.8}$ (solve for F)

(multiply both sides by **1.8**) $1.8 \times C = \frac{(F - 32)}{\cancel{1.8}} \times \cancel{1.8} \rightarrow 1.8 \times C = F - 32$

(add **32** to both sides) $32 + 1.8 \times C = F - 32 + 32 \rightarrow 32 + 1.8 \times C = F$

6) $\frac{R \times S}{T} = \frac{Y \times Z}{W}$ (solve for Y)

(multiply both sides by **W**) $\frac{W \times R \times S}{T} = \frac{Y \times Z \times \cancel{W}}{\cancel{W}} \rightarrow \frac{W \times R \times S}{T} = Y \times Z$

(divide both sides by **Z**) $\frac{W \times R \times S}{T \times Z} = \frac{Y \times \cancel{Z}}{\cancel{Z}} \rightarrow \frac{W \times R \times S}{T \times Z} = Y$

7) $\frac{R \times S}{T} = \frac{Y \times Z}{W}$ (solve for T)

(multiply both sides by T) $\frac{T \times R \times S}{T} = \frac{Y \times Z \times T}{W} \rightarrow R \times S = \frac{Y \times Z \times T}{W}$

(multiply both sides by W) $W \times R \times S = \frac{Y \times Z \times T \times W}{W} \rightarrow W \times R \times S = Y \times Z \times T$

(divide both sides by Z) $\frac{W \times R \times S}{Z} = \frac{Y \times Z \times T}{Z} \rightarrow \frac{W \times R \times S}{Z} = Y \times T$

(divide both sides by Y) $\frac{W \times R \times S}{Z \times Y} = \frac{Y \times T}{Y} \rightarrow \frac{W \times R \times S}{Z \times Y} = T$

8) $50.0 \times 4.18 \times (T - 23) = -62.7 \times 0.312 \times (T - 142)$

$50.0 \times 4.18 \times (T - 23) = -62.7 \times 0.312 \times (T - 142) \rightarrow 209 \times (T - 23) = -19.5624 \times (T - 142)$

(divide by 209) $\frac{209 \times (T - 23)}{209} = \frac{-19.5624 \times (T - 142)}{209} \rightarrow T - 23 = -0.0936 \times (T - 142)$

(distribute -0.0936) $T - 23 = -0.0936 \times T - 0.0936 \times -142 \rightarrow T - 23 = -0.0936T + 13.2912$

(add 23 to both sides) $T - 23 + 23 = -0.0936T + 13.2912 + 23 \rightarrow T = -0.0936T + 36.2912$

(add 0.0936T to both sides) $0.0936T + T = -0.0936T + 36.2912 + 0.0936T \rightarrow 1.0936T = 36.2912$

(divide by 1.0936) $\frac{1.0936T}{1.0936} = \frac{36.2912}{1.0936} \rightarrow T = 33.19$

9) $\frac{n}{781.2} \times 100 = 23.71$

(multiply both sides by 781.2) $\frac{781.2 \times n}{781.2} \times 100 = 23.71 \times 781.2 \rightarrow n \times 100 = 18522.252$

(divide both sides by 100) $\frac{n \times 100}{100} = \frac{18522.252}{100} \rightarrow n = 185.2$

10) $\frac{0.113}{d} \times 100 = 76.2$

(multiply both sides by d) $\frac{d \times 0.113}{d} \times 100 = 76.2 \times d \rightarrow 0.113 \times 100 = 76.2 \times d$

(divide both sides by 76.2) $\frac{0.113 \times 100}{76.2} = \frac{76.2 \times d}{76.2} \rightarrow 0.148 = d$

11) $\frac{11.16}{16.11} \times 100 = p$ → $69.27 = p$

12) $\frac{25.0}{25.0 + s} \times 100 = 28.1$

(multiply both sides by **25.0 + s**)

$$\cancel{(25.0 + s)} \frac{25.0}{\cancel{25.0 + s}} \times 100 = 28.1 \times (25.0 + s) \rightarrow 25.0 \times 100 = 28.1 \times (25.0 + s)$$

(divide both sides by **28.1**) $\frac{25.0 \times 100}{28.1} = \frac{\cancel{28.1} \times (25.0 + s)}{\cancel{28.1}} \rightarrow \frac{25.0 \times 100}{28.1} = 25.0 + s$

(subtract **25.0** from both sides) $88.968 - 25.0 = 25.0 + s - 25.0$ → $64.0 = s$

13) $ln\left(\frac{k_2}{0.000122}\right) = \frac{1.32 \times 10^5}{8.314}\left(\frac{1}{300.0} - \frac{1}{290.0}\right)$

(simplify the **right side**)

$$ln\left(\frac{k_2}{0.000122}\right) = \frac{1.32 \times 10^5}{8.314}(-0.000114942) \rightarrow ln\left(\frac{k_2}{0.000122}\right) = -1.824923478$$

(take the **inverse natural log** {e^} of each side)

$$e^{ln\left(\frac{k_2}{0.000122}\right)} = e^{-1.824923478} \rightarrow \frac{k_2}{0.000122} = 0.161229981$$

(multiply both sides by **0.000122**)

$$\cancel{0.000122} \times \frac{k_2}{\cancel{0.000122}} = 0.161229981 \times 0.000122 \rightarrow k_2 = 1.97 \times 10^{-5}$$

14) $\frac{1}{C} = \frac{0.055}{M \cdot s} \cdot 75s + \frac{1}{0.250\ M}$

(simplify the **right side**)

$$\frac{1}{C} = \frac{4.125}{M} + \frac{1}{0.250\ M} \rightarrow \frac{1}{C} = \frac{8.125}{M}$$

(take the **inverse** of both sides in order to get **C** on top)

$$\frac{C}{1} = \frac{M}{8.125} \rightarrow C = 0.1231\ M$$

15) $ln(\mathbf{P}) = \frac{-0.00780}{\text{s}} \times 250\text{s} + ln(1.000)$

(simplify the **right side**)

$$ln(\mathbf{P}) = \mathbf{-1.95} + 0$$

(take the **inverse natural log** {e^} of each side)

$$\mathbf{e}^{ln(P)} = \mathbf{e}^{-1.95} \rightarrow \mathbf{P = 0.142274071} \rightarrow \boxed{P = 0.14}$$

16) $ln(0.1615) = E_a\left(\frac{1}{300.15\text{ K}} - \frac{1}{290.15\text{ K}}\right)$

(simplify the **right side**)

$$ln(0.1615) = E_a(\mathbf{-0.000114825})$$

(simplify the **left side**)

$$\mathbf{-1.823250136} = E_a(-0.000114825)$$

(divide both sides by **-0.000114825**)

$$\frac{-1.823250136}{\mathbf{-0.000114825}} = \frac{E_a\cancel{(-0.000114825)}}{\cancel{\mathbf{-0.000114825}}} \rightarrow \boxed{\mathbf{E_a} = 1.59\times10^4}$$

17) $e^{\left(\frac{J}{8.314\times10^{-3}\times312.15}\right)} = 3.355$

(take the **natural log** {ln} of each side)

$$ln\left(e^{\left(\frac{J}{8.314\times10^{-3}\times312.15}\right)}\right) = ln(3.355) \rightarrow \frac{J}{8.314\times10^{-3}\times312.15} = 1.21045177 \rightarrow \boxed{\mathbf{J} = 3.141}$$

18) $-455\times0.387\times(T-89.5) = 455\times4.184\times(T-22.8) + 10.0\times(T-22.8)$

$$\mathbf{-176.085}\times(T-89.5) = \mathbf{1903.72}\times(T-22.8) + 10.0\times(T-22.8)$$

$$-176.085\times(T-89.5) = (\mathbf{1903.72 + 10.0})\times(T-22.8)$$

$$-176.085\times(T-89.5) = \mathbf{1913.72}\times(T-22.8)$$

$$T-89.5 = \mathbf{-10.8682}\times(T-22.8)$$

$$T-89.5 = \mathbf{-10.8682}T + \mathbf{247.794}$$

$$\mathbf{11.8682}T = \mathbf{+337.2941}$$

$$\boxed{\mathbf{T} = 28.4}$$

Simplify the following:

19) $x^2 \bullet x^4$ → x^{2+4} → x^6

20) $\frac{k^8}{k^3}$ → k^{8-3} → k^5

21) $a^{11} \bullet a^{-7}$ → $a^{11+(-7)}$ → a^4

22) $\frac{w^{-4}}{w^{-7}}$ → $w^{-4-(-7)}$ → w^3

23) $r^3 \bullet \frac{t^5}{r}$ → $r^3 \bullet r^{-1} \bullet t^5$ → $r^{3-1} \bullet t^5$ → $r^2 \bullet t^5$

24) $(4m)^3$ → $4^3 m^3$ → $64m^3$

25) $\left(\frac{1\,s}{2.14\,m}\right)^2$ → $\frac{1^2 s^2}{2.14^2 m^2}$ → $\frac{0.218 s^2}{m^2}$

26) $a^2 \times \frac{p^{-2}}{f^2} \times \frac{d}{a^2} \times \frac{f^3}{p^{-2}} \times \frac{1}{d} \times \frac{w}{u^{-1}} \times \frac{n^2}{w}$ → $a^2 \times \frac{p^{-2}}{f^2} \times \frac{d}{a^2} \times \frac{f^3}{p^{-2}} \times \frac{1}{d} \times \frac{w}{u^{-1}} \times \frac{n^2}{w}$ →

$a^2 \times \frac{p^{-2}}{f^2} \times \frac{d}{a^2} \times \frac{f^3}{p^{-2}} \times \frac{1}{d} \times \frac{w}{u^{-1}} \times \frac{n^2}{w}$ → $\frac{f^{3-2} n^2}{u^{-1}}$ → $f \bullet u \bullet n^2$

27) $\frac{d \bullet L}{K \bullet \frac{d \bullet L}{m \bullet K}}$ → $\frac{1}{\frac{1}{m}}$ → m

Arithmetic:

28) $\frac{872.9}{61.77 \times 13.33} = 1.060$

29) $\frac{7.1031 \times 10^{21}}{6.022 \times 10^{23}} = 0.01180$ (huge exponent on the 10 means you used your calculator incorrectly)

30) $-\log(0.00712) = 2.15$

31) $57.8\ \cancel{k} \times \frac{2.20\ \cancel{p}}{1\ \cancel{k}} \times \frac{1\ \cancel{s}}{16\ \cancel{p}} \times \frac{1\ n}{1\times10^{-9}\ \cancel{s}} =$ 7947500000 n or $7.9475\text{x}10^{9}$ n ($7.95\text{x}10^{9}$ n with sig. figs.)

32) inverse log of -9.12 → $10^{-9.12} =$ $7.59\text{x}10^{-10}$

33) $47.8\ \cancel{in^3} \times \left(\frac{2.54\ \cancel{cm}}{1\ \cancel{in}}\right)^3 \times \frac{2.70\ \cancel{g}}{1\ \cancel{cm^3}} \times \frac{1\ \cancel{kg}}{1\times10^{3}\ \cancel{g}} \times \frac{1\ lb}{0.45359\ \cancel{kg}} =$ 4.66 *lb*

34) $\log(5.54\text{x}10^{-11}) =$ -10.3

35) $\frac{712\times61.8\times273}{299\times760} =$ 52.9

36) $10^{-3.80} =$ 0.000158 or $1.58\text{x}10^{-4}$

37) $\frac{2.66\ \cancel{atm}\times15.8\ \cancel{L}}{417\ \cancel{K}\times0.0821\frac{\cancel{atm}\times\cancel{L}}{mol\times\cancel{K}}} =$ 1.23 mol

38) $\frac{7.23-7.81}{7.81}\times100 =$ -7.43

39) $-\log(1\text{x}10^{-8}) =$ 8

40) $\frac{60}{5+10} =$ 4

41) $\sqrt{\frac{(1.706-1.20)^2+(1.706-1.46)^2+(1.706-1.700)^2+(1.706-2.220)^2}{3}}$

$$\sqrt{\frac{(0.506)^2+(.246)^2+(0.006)^2+(-0.514)^2}{3}}$$

$$\sqrt{\frac{0.256036+0.060516+0.000036+0.264196}{3}}$$

$$\sqrt{\frac{0.580778}{3}} = 0.440$$

42) $(-394.4 \bullet 2) - (2 \bullet -137.2 + 2 \bullet 87.6)$

$(-788.8) - (-99.2) = -689.6$

43) $e^{\left(\frac{-(-51.0)}{8.314\times10^{-3}\times298.15}\right)}$ → $e^{(20.57431299)} = 8.62\text{x}10^{8}$

44) $\sqrt[4]{16.11} = 2.003$

45) $71^{2/3} = 17$

46) $\frac{1}{2.998\times10^{10}} = 3.336\text{x}10^{-11}$