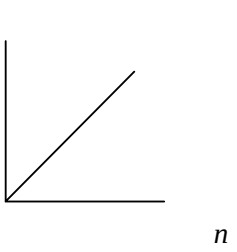
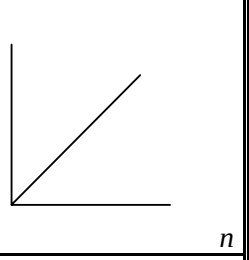
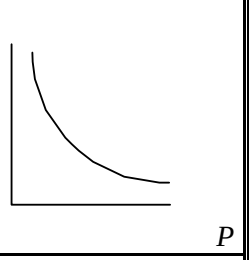
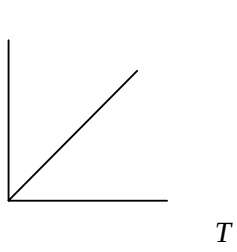
1 A

2

Factors affecting the volume	Literal statements	Mathematical statements	Graphic representation
1. Quantity	at constants (T and P) $V \propto n$ $\propto$ = proportional	$\frac{V_1}{n_1} = \frac{V_2}{n_2}$	
2. Pressure-Quantity	at constants (T and V) $P \propto n$	$\frac{P_1}{n_1} = \frac{P_2}{n_2}$	
3. Pressure	at constants (T and n) $V \propto 1/P$	$P_1V_1 = P_2V_2$	
4. Temperature	at constants (P and n) $V \propto T$ T(K) = T(°C) + 273	$\frac{V_1}{T_1} = \frac{V_2}{T_2}$	

3 Solution :

$Cu_{(s)} \rightarrow Cu^{2+}_{(aq)} + 2e^-$ -0.34 V

$Ag_{(s)} \rightarrow Ag^{+}_{(aq)} + 1e^-$ -0.80 V

Oxydation	$Cu_{(s)} \rightarrow Cu^{2+}_{(aq)} + 2e^-$	-0.34 V
Reduction	$2\ Ag^+ + 2e^- \rightarrow 2Ag_{(s)}$	-(-0.80 V)
Redox	$Cu_{(s)} + 2\ Ag^{+}_{(aq)} \rightarrow Cu^{2+}_{(aq)} + 2\ Ag_{(s)}$	+ 0.46 V

Answer : + 0.46 V

4 B

5 B

6 The acids in increasing order of their strengths are : HZ, HX, HY. You need to compare K_A's.
HZ's Ka = only 6.4 X 10^{-6}; HX = 6.9 X 10^{-4} and HY has the largest at 3.1 X 10^{-3}. Note that one of the solutions has a higher pH (less H+) but is considered a stronger acid because its getting more "mileage" out of its low concentration (HY with its 0.0010M is prepared 100 times weaker than HX at 0.10 M, but because HY is stronger it created a pH that is only 10 X weaker)

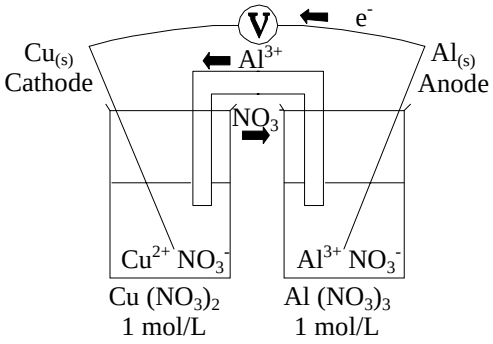
7 The student was able to :
- identify the ions in the solution;
- indicate direction of motion of the electrons and of the ions in the solution;
- calculate the potential difference of the cell.

Example :

1) Electron flow
$Al_{(s)}$ electrode $\rightarrow$ $Cu_{(s)}$ electrode

2) Ions in solution
At the cathode, $Cu_{(s)}$
Cu^{2+} and NO_3^-
At the anode, $Al_{(s)}$
Al^{3+} and NO_3^-

3) Motion of the ions
Al^{3+} moves towards cathode $Cu_{(s)}$ through the salt-bridge.



4) The potential difference of the cell

$2 \times (Al_{(s)} \rightarrow Al^{3+}_{(aq)} + 3e^-)$ $\quad E° = 1.66$ V

$3 \times (Cu^{2+}_{(aq)} + 2e^- \rightarrow Cu_{(s)})$ $\quad E° = 0.34$ V

$2\ Al_{(s)} + 3\ Cu^{2+}_{(aq)} \rightarrow 2\ Al^{3+}_{(aq)} + 3\ Cu_{(s)}$ $\quad E° = 2.00$ V

8 A) Water reduces or eliminates the «heat» component of the fire triangle.

B) CO_2 reduces or eliminates the «oxygen» component of the fire triangle.

9 Acid Y is stronger than acid X because although it started with a weaker concentration it still gave the same pH

or

The dissociation of acid Y is greater than that for acid X.

Here is a more mathematical argument:

From ice chart Ka for X, call it Kx = [H+]^2/[HX].

Similarly Ka for Y = Ky = [H+]^2/[HY].

Since pH is equal, then the [H+]^2 's are equal to each other.

Substituting we would get:

Kx[HX] = Ky[HY]

We were told at the beginning that [HX]>[HY], so because of the inverse relationship in the above equation, Ky is obviously> Kx

10 C

11 **Example of an appropriate procedure**

$Zn^0_{(s)} \rightarrow Zn^{2+}_{(aq)} + 2\ e^-$ $\quad E° = 0.76$ V

$Ag^+_{(aq)} + 1e^- \rightarrow Ag^0_{(s)}$ $\quad E° = 0.80$ V

Multiply by 2

$2\ Ag^+_{(aq)} + 2e^- \rightarrow 2\ Ag^0_{(s)}$ $\quad E° = 0.80$ V

Net redox equation

$Zn^0_{(s)} + 2\ Ag^+_{(aq)} \rightarrow Zn^{2+}_{(aq)} + 2\ Ag^0_{(s)}$ $\quad E°_{cell} = E°_{Zn} + E°_{Ag}$

$E°_{cell} = 0.76$ V + 0.80 V

$E°_{cell} = 1.56$ V

Answers

Net redox equation: $Zn^0_{(s)} + 2\ Ag^+_{(aq)} \rightarrow Zn^{2+}_{(aq)} + 2\ Ag^0_{(s)}$
Standard cell potential for this cell: 1.56 V

12 D

13 **Example of an appropriate and complete answer**

1. $2\ Ag^+ + \cancel{2}^{e-} \rightarrow 2\ Ag_{(s)}$ +0.80 V

   $\underline{Mg_{(s)} \rightarrow Mg^{2+} + \cancel{2}^{e-}}$ +2.37 V

   $2\ Ag^+ + Mg_{(s)} \rightarrow 2\ Ag_{(s)} + Mg^{2+}$

2. $E°$ = **3.17 V**

3. **Mg** is the reducing agent.