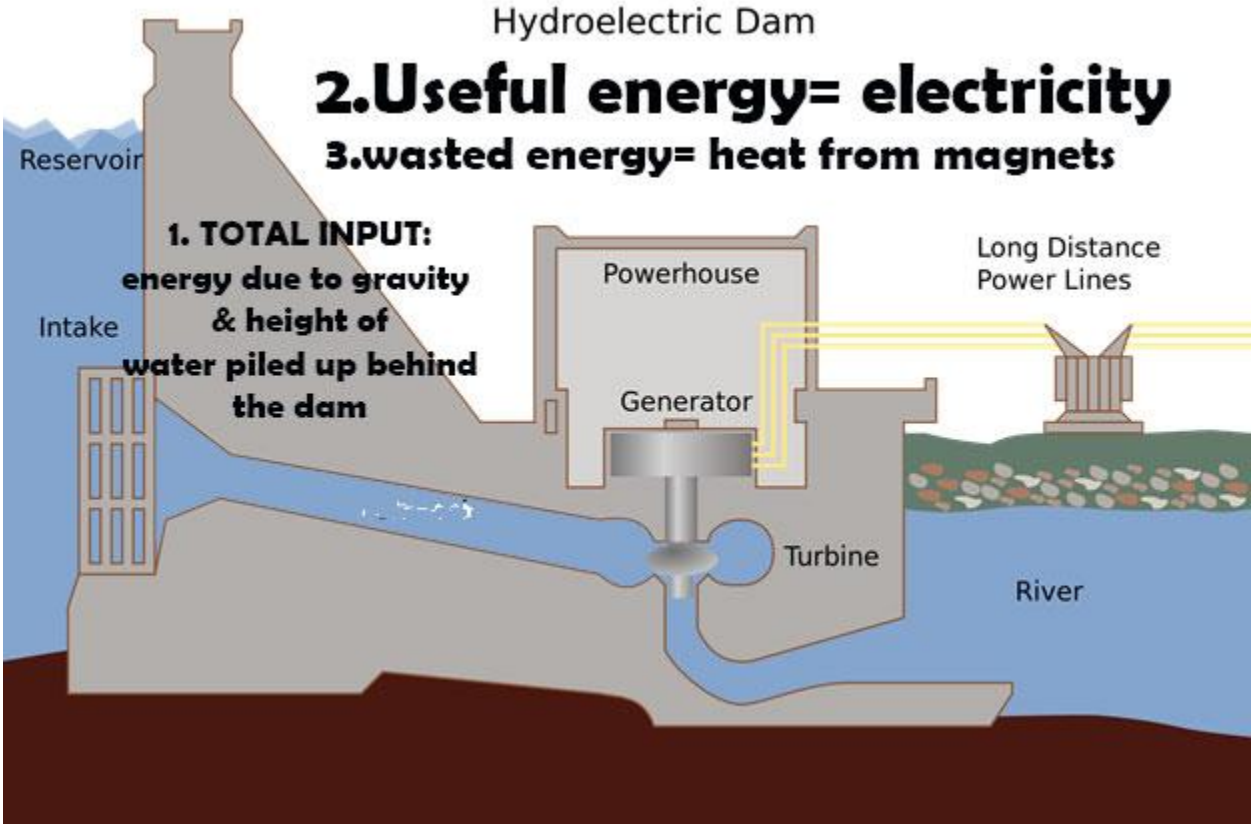
Practice for Common Assessment:

Based on an analysis of all LHA ST exams, the following problem areas were identified. (These were the areas leading to the most mistakes.) We will soon be retesting these (on Mon May 9—UVA's 04 group), so avoid getting wrong again.

CONCEPT 1 : % EFFICIENCY

MODEL Examples (done for you and to be used as a guide for your homework)



a) What formula relates the total input to useful and wasted energy?

Answer: *total input = useful + wasted* *(not given on tests)*

b) What formula can be used to calculate the % efficiency of this hydroelectric dam?

$$\%\, efficiency = \frac{useful\ energy}{total\ input} \times 100\%$$ *(given on tests)*

c) Hoover Dam has an input of 16 trillion kJ of energy every year. In that same period, it generates 14.4 trillion kJ of electricity. What is its efficiency?

$$\%\ efficiency = \frac{useful\ energy}{total\ input} \times 100\%$$

$\%\ efficiency = \frac{14.4}{16} \times 100\%$ = 90 % (notice that the trillion kJ cancels)

d) Smaller dams are not as efficient as Hoover Dam. A small dam by Canadian Hydro Developers is 85% efficient. With an input of 1.6 trillion kJ/year how much electricity will be generated every year?

$$\%\ efficiency = \frac{useful\ energy}{total\ input} \times 100\%$$

$$\frac{85}{100} = \frac{x}{1.6}$$

$0.85 = \frac{x}{1.6}$

x = useful energy = 0.85(1.6) = 1.36

Since 1.6 was really 1.6 trillion kJ, final answer = 1.36 trillion kJ.

e) A different small dam wasted 0.2 trillion kJ per year with an input of 1.0 trillion kJ annually. What is its efficiency?

total input = useful + wasted

1.0 = useful + 0.2 all in trillion kJ

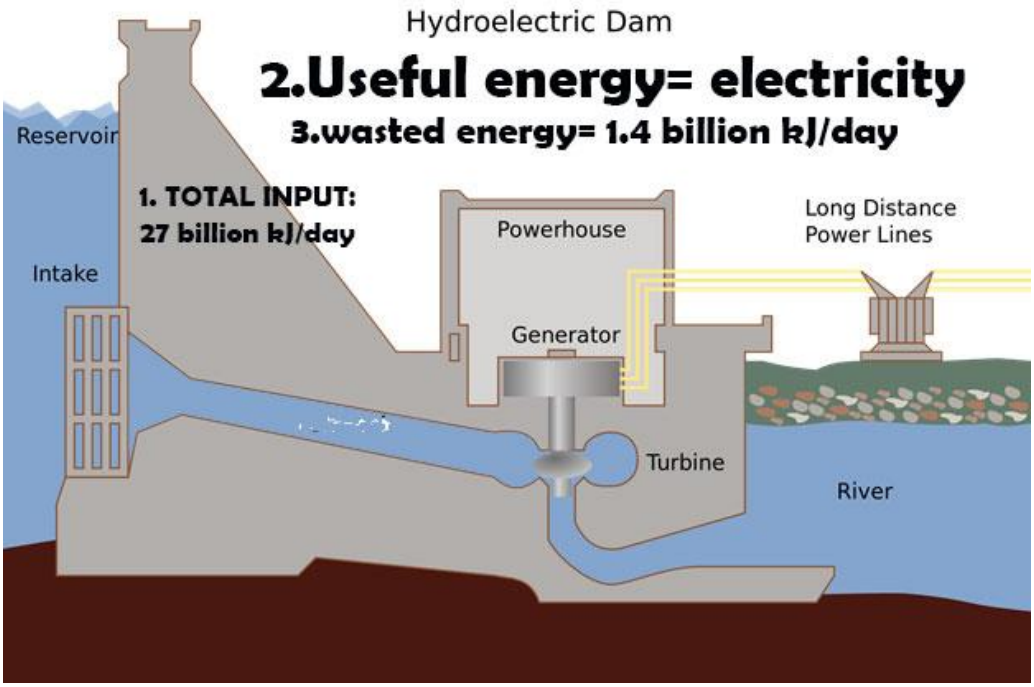
Useful = 1.0 - 0.2 = 0.8 trillion kJ

$$\%\ efficiency = \frac{useful\ energy}{total\ input} \times 100\%$$

$$\%\ efficiency = \frac{0.8}{1.0} \times 100\% = 80\%$$

Exercises:

1. Find the amount of electrical energy generated and the % efficiency.



$$\%\ efficiency = \frac{useful\ energy}{total\ input} \times 100\%$$

$$\%\ efficiency = \frac{(27-1.4)billion}{27\ billion} \times 100\% = 95\%$$

2. A small dam wasted 0.15 trillion kJ per year with an input of 1.2 trillion kJ annually. What is its efficiency?

Useful electricity = (1.2 – 0.15) trillion kJ= 1.85 trillion kJ

$$\%\ efficiency = \frac{1.85\ \text{trillion kJ}}{2\ \text{trillion kJ}} \times 100\% = 93\%$$

3. If a power plant with an efficiency of 92% is generating 8.5 trillion kJ of electricity annually, how much energy is being lost by the magnets?

$$\frac{92}{100} = \frac{8.5 \text{ trillion kJ}}{\text{total input(x)}}$$

92 x = 8.5(100)
x = 8.5(100)/92 = 9.2 trillion kJ
wasted = 9.2 trillion kJ - 8.5 trillion kJ = 0.7 trillion kJ

CONCEPT 2: Metalloids versus Metals and Nonmetals

You should know the following before answering the questions

metalloids	Semiconductors of electricity, poor conductors of heat, don't react with acid, lustrous, brittle. They border the staircase of the periodic table: B, Si, Ge , As etc
metals	Good conductors of electricity and heat;, usually react with acid, lustrous, malleable. They're on the left side of staircase in the periodic table
Non-metals	Poor conductors of electricity and heat;, don't react with acid, not lustrous They're on the right side of staircase in the periodic table

CONCEPT 3: Acids Versus Bases

You should know the following before answering the questions

acids	pH < 7. For each unit smaller than 7, the acid becomes 10 times more concentrated. Acids form H^+ in water and their formulas are often in the form of HX. They turn blue litmus red They taste sour, neutralize bases and react with many metals to release hydrogen gas.

bases	pH > 7. For each unit bigger than 7, the base becomes 10 times more concentrated. Bases form OH^- in water and their formulas are often in the form of MOH, where M = metal. They turn red litmus blue They taste sour, neutralize acids and DON"T react with metals to release hydrogen gas.

4. What name is given to periodic table elements that are semi-conductors of electricity and which do not react with acid?

(A) Alkali metals
(B) Alkaline earth metals
(C) Metals
(D) Metalloids

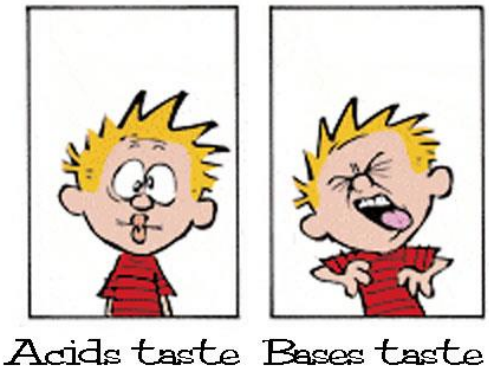
5. Which should you use to distinguish between metals and metalloids in the lab?

1. Conductivity test
2. Acid test
3. Observations regarding luster
4. Observations regarding malleability

(A) 1, 2
(B) 2, 3
(C) 1, 3
(D) 2, 4

6. Which of these sets of elements are ALL metalloids?

(A) Al, B, Si, Ge
(B) B, Si, Ge, As
(C) Si, Ge, As, I
(D) B, Si, Ge, P



7. Which of the following is an acid?

(A) A substance that keeps blue litmus blue
(B) A bitter-tasting substance
(C) A substance with a high pH
(D) A substance that destroys a base.

8. If the concentration of a solution of HCl is 10 times higher than a vinegar solution whose pH = 2.60, what is the pH of that HCl sample?

(A) 0.16
(B) 1.60 = 2.60 -1 because it's based on exponents and $10 = 10^1$
(C) 3.60
(D) 26

9. Which statement regarding acids is FALSE?

(A) Acids are all weak electrolytes.
(B) Acids contribute H^+ to a solution.
(C) H^+ is responsible for an acid's properties.
(D) An acidic solution does not feel slippery.

CONCEPT 4: Neutralization

In a neutralization, an acid of the form HX reacts with a base(MOH) to make HOH = H_2O, and a salt of the form MX. It's as if the H and the M switch partners. $HX + MOH \rightarrow H_2O + MX$

10. A base is neutralized with an acid as shown:

$Mg(OH)_2 + 2HF \rightarrow 2H_2O + \_MgF_2$ _____

What is the missing compound?

(A) MgH_2

(B) MgF_2

(C) MgF

(D) FOH

11. Which equation below correctly represents the neutralization reaction of HCl and NaOH?

(A) $HCl + NaOH \rightarrow Cl + H_2O$

(B) $HCl + NaOH \rightarrow NaO + H_2Cl$

(C) $HCl + NaOH \rightarrow NaH + ClOH$

(D) $HCl + NaOH \rightarrow NaCl + H_2O$

12. Potassium hydroxide KOH is neutralized with sulfuric acid H_2SO_4.

Which balanced equation correctly represents the neutralization reaction?

(A) $KOH + H_2SO_4 \rightarrow H_2O + KSO_4$

(B) $KOH + H_2SO_4 \rightarrow H_2O + K_2SO_4$

(C) $KOH + H_2SO_4 \rightarrow OHSO4 + KH_2$

(D) $2KOH + H_2SO_4 \rightarrow 2\,H_2O + K_2SO_4$

CONCEPT 5: Concentration

Examples:

The formula given to you is $C = \frac{mass\ of\ solute}{Volume\ of\ solution}$ the unit is g/L

a) How many grams of solute would you need to make 600 mL of a 3.40 g/L ?

Answer: $C = \frac{mass\ of\ solute}{Volume\ of\ solution}$ convert 580 ml to 0.600 L

$$3.40\ g/L = \frac{m}{0.600\ L}$$

m = 3.40 g/L* 0.600 L = 2.04 g

b) You dissolve 0.80 g of solute in a certain amount of water. The concentration is 0.45 g/L. How much water in ml did you use ?

Answer: $C = \frac{mass\ of\ solute}{Volume\ of\ solution}$

$$C = \frac{0.80\ g}{V} = 0.45\ g/\text{L}$$

0.45 V = 0.80

V= 0.80÷ $0.45 = 1.77\ L = 1770\ ml$

13. How many grams of solute would you need to make a 3.4 g/L solution that has a volume of 580 mL ?

(A) 170.59 g
(B) 1.97 g
(C) 1972 g
(D) 0.17 g

14. You dissolve 8 g of solute in a certain amount of water. The concentration is 5.4 g/L. How much water did you use ?

(A) 1.48 mL
(B) 1481 mL
(C) 0.68 mL
(D) 0.68 L

15. What is the concentration of a 60 mL solution that contains 25 grams of solute ?

(A) 41.67 g/L
(B) 0.417 g/L
(C) 417 g/L
(D) 2.4 g/L