# Chemistry 512 Review Questions for Final Exam

Name: Answer Key

1. Give a list of different forms of energy. Separate by Potential & Kinetic.

Stored energy
Chemical Bonds

Movement
Wind
Ball rolling down a hill.

2. A student measured the density of aluminum to be the following results:

2.69 g/ml 2.71 g/ml 2.72 g/ml 2.68 g/ml

The accepted value of the density of aluminum is 2.70 g/ml

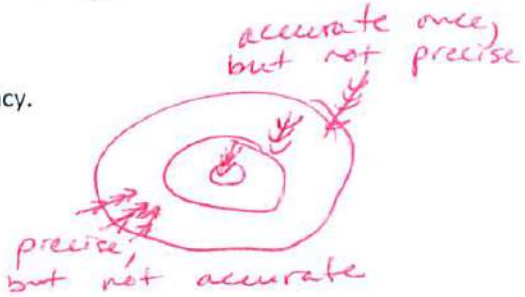
Choose the correct comment of the student's precision and accuracy.

a. The student is not precise, but is fairly accurate.

b. The student is precise and fairly accurate.

c. The student is not precise and not accurate.

d. The student is precise and not accurate.




precision - repeat results
accuracy - obtain accepted results

3. Using the last value (2.68 g/ml) find the % error of the measurement above in #2.

$$\frac{2.68 - 2.7}{2.7} = -.7\% = \frac{\text{observed} - \text{expected (accepted)}}{\text{expected (accepted)}} \times 100$$

4. a) What is a control in an experiment?

- Basis of comparison
- contains constants, but no variables

b) What type of controls should be used in the water testing lab that tests the quality of Scarsdale water supply? Distilled water (pure water)

5. a) List the different types of glassware that we have used in Chemistry.

Erlenmeyer flask, Beaker, test tubes, buret, base
graduated cylinder

measure of concentration of acid or base

quantity of solution

b) What should you do if you broke a glass beaker in the lab?

Report to teacher, get dust pan and broom, put in Broken glass bin

Factor-label Method $\frac{\text{Given}}{1} \times \frac{\text{unit to be found}}{\text{unit to be canceled}} = $ _____

6. In France, if you wanted 5 gallons of gasoline, how many liters should you ask for at the gas station? (1 gal = 3.78 L)

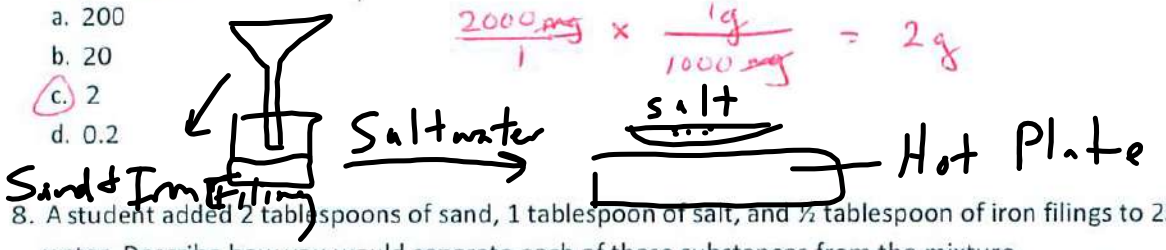
a. 18.9 L b. .756 L c. 189 L d. 7.56 L

$\frac{5\text{ gal}}{1} \times \frac{3.78\text{ L}}{1\text{ gal}} = 18.9\text{ L}$

7. If the mass of a substance is determined to be 2000 milligrams (mg), then how much is it in grams (g)?

a. 200
b. 20
c. 2
d. 0.2

$\frac{2000\text{ mg}}{1} \times \frac{1\text{ g}}{1000\text{ mg}} = 2\text{ g}$




8. A student added 2 tablespoons of sand, 1 tablespoon of salt, and ½ tablespoon of iron filings to 250 mL of water. Describe how you would separate each of these substances from the mixture.

A) Filter sand and iron filings from salt water
B) Evaporate water from salt
C) Use magnet to separate iron filings from sand.

9. Which of the following is the definition of an isotope?

a. atoms that have different proton numbers
b. atoms that have different electron numbers
c. atoms that have different neutron numbers
d. atoms that have different atomic numbers

Mass # - Atomic # = # of neutrons

Protium, Deuterium, Tritium
$^{1}H$, $^{2}H$, $^{3}H$
Same atomic #, same element

10. The chemical symbol, Ni, represents which of the following elements?

a. Nitrogen - N
b. Neon - Ne
c. Sodium - Na
d. Nickel

11. The atomic number represents:

a. amount of neutrons
b. amount of protons
c. amount of protons plus neutrons
d. amount of electrons

12. The mass number represents:

a. amount of neutrons
b. amount of protons
c. amount of protons plus neutrons
d. amount of electron

substance reacts with another substance

property based on amount

13. When mass changes based on the amount of substance that you have, this is a
   a. Chemical intensive property  b. Chemical extensive property
   c. Physical intensive property  d. Physical extensive property

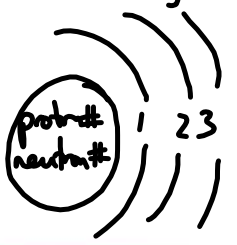
property not dependent on amount

observable property without reference to another substance

14. The definition of density is:
   a. Weight of an object
   b. Mass per unit volume
   c. Volume of an object
   d. Volume multiplied be the mass

$$\text{Density} = \frac{\text{mass (g)}}{\text{volume (mL)}}$$

Electron Configuration



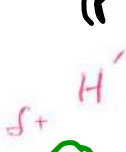

15. Complete the chart.

(Atm) Atomic # — Atomic # — Mass# − Atomic # — Mass# — Memorize

| ELEMENT | # PROTON | # ELECTRONS | # NEUTRONS | MASS # | SYMBOL | BOHR MODEL |
|---|---|---|---|---|---|---|
| Potassium | 19 | 19 | 20 | 39 | K | 19p 20n 2 8 8 1 |

16. The shape of a water molecule is:
   a. Linear
   b. Bent
   c. U-shaped
   d. circular

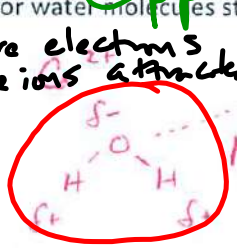
$\delta$ = delta (partially) Polar Covalent Bond

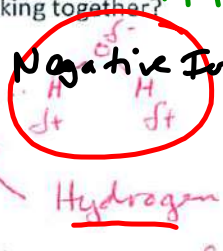



Polar molecule

Opposites Attract (salt)

17. Which is most responsible for water molecules sticking together?
   a. Covalent bonds – Share electrons
   b. Ionic bonds – Positive ions attracted Negative Ions
   c. Hydrogen bonds
   d. Van der Waals forces




Cl⁻

Hydrogen Bonding

$CaCl_2$ dissolves in $H_2O$

$Ca^{2+}$ $Cl_2^{1-}$

Weak forces

18. Define the following:

A) Element – a pure substance made up of the same atoms, ex. Au, $Cl_2$, C

B) Compound – a substance made up of 2 or more elements in a fixed proportion ex. $H_2O$, $CO_2$, NaCl

C) Homogeneous Mixture – 2 or more substances together mixed evenly throughout ex. Salt in water, Sugar in Water

D) Heterogenous Mixture – 2 or more substances together, but not evenly mixed throughout ex. Sand in water, Iron Filings & Sand.

E) Substance – Elements or a Compound, it is not a mixture.

19. Which of the following is **not** a characteristic of a metal?
   a. It is malleable
   b. It has metallic luster
   c. It is ductile — wire
   d. It is brittle (nonmetal)

shiny, malleable, conducts electricity, must be a solid at room temperature except Hg.

20. When water changes from ice to liquid water, this is known as:
   a. Boiling $l \rightarrow g$ evaporation
   b. Freezing $l \rightarrow s$ solidification
   c. Melting $s \rightarrow l$
   d. Condensation $g \rightarrow l$

sublimation $s \rightarrow g$

21. When a substance is observed undergoing oxidation in air, what type of change is this?
   a. Physical
   b. Chemical
   c. Nuclear (nucleus breaks down)
   d. Emotional

lose electrons

22. When **stored energy** is available within a chemical compound, this type of energy is known as:
   a. Potential energy — Chemical bond
   b. Kinetic energy - particle movement
   c. Electrical energy - e- movement
   d. None of the above

(Gas → Temperature)


23. The 1st column on the Periodic table represents _____.
   a. Halogens - 17TH
   b. Noble gases - 18TH
   c. Alkaline earth metals - 2nd
   d. Alkali metals - 1ST

Synthesis Reaction $A+B \rightarrow AB$
Decomposition Reaction $AB \rightarrow A+B$
Single Replacement Reaction $A+BC \rightarrow AC+B$
Double Replacement Reaction $AB+CD \rightarrow AD+CB$
Combustion Reaction $CH+O_2 \rightarrow CO_2+H_2O$

24. Fill in any missing substances, balance the reaction and determine the type.

a. $CH_4 + 2\,O_2 \rightarrow CO_2 + 2H_2O$ + ENERGY

| R | P |
|---|---|
| 1C | 1C |
| 4O | 2O 4 |
| 4H | 2H 4 |

Type of Reaction: Combustion Reaction

Exothermic
$\Delta H = -$ J

b. $Br_2\ I_2\ N_2\ Cl_2\ H_2\ O_2\ F_2$ $Cl_2 + 2\,NaBr \rightarrow 2\,NaCl + Br_2$

| R | P |
|---|---|
| 2 Na | 2 Na |
| 2 Cl | 2 Cl |
| 2 Br | 2 Br |

Type of Reaction: Single Replacement Reaction

Postively charged ions first — Negatively charged ions second

25. Fill in the missing information.

| Compound | Symbol and charge for + ion | Symbol and charge for - ion | Number of each type of ion (Write the ion and the number of that ion in the formula) | English Name for the compound (-ide ending) |
|---|---|---|---|---|
| 1) $Fe_2O_3$ (criss cross up) | $Fe^{3+}$ | $O^{2-}$ | 2 Fe ions; 3 O ions | Iron (III) Oxide |
| 2) CaS (reduce 2:2 = 1:1) | $Ca^{2+}$ | $S^{2-}$ | 1 Ca ion; 1 S ion | Calcium Sulfide |
| 3) $Ca(NO_3)_2$ | $Ca^{2+}$ (criss) | $NO_3^{1-}$ (cross down) | 1 Ca ion; 2 $NO_3$ ions | Calcium Nitrate |

26. The amount of electrons that are found in the outermost shell (principal energy level) is known as:

a. Protons
b. Ions - charged particles
c. Atomic Number
(d.) Valence electrons

27. What is the electron configuration of Bromine? Br — from Periodic Table

(a.) 2-8-18-7
b. 2-3
c. 2-2
d. 2-8-18

Carbon Monoxide - CO
Carbon Dioxide - $CO_2$
Dinitrogen Trioxide - $N_2O_3$
Carbon Tetrachloride - $CCl_4$

28. Fill in the prefixes for the IUPAC names.

| | |
|---|---|
| One | Mono |
| Two | Di |
| Three | Tri |
| Four | Tetra |

29. Fill in the organic prefixes for the following Alkanes.

| | | | |
|---|---|---|---|
| $CH_4$ | Methane | $C_6H_{14}$ | Hexane |
| $C_2H_6$ | Ethane | $C_7H_{16}$ | Heptane |
| $C_3H_8$ | Propane | $C_8H_{18}$ | Octane |
| $C_4H_{10}$ | Butane | $C_9H_{20}$ | Nonane |
| $C_5H_{12}$ | Pentane | $C_{10}H_{22}$ | Decane |

$CaBr_2$ → Ca = 40; 2Br = 2 × 80 = 160; Total Mass = Whole Mass 200 — %Ca: $\frac{40}{200} = \frac{1}{5} = 20\%$

30. What is the percent composition of Na in the compound NaBr?
SHOW WORK Atomic masses

Na - 23 g
Br - 80 g
Total NaBr - 103 g

$\frac{23\text{ g}}{103\text{ g}} \times 100 = 22\%$

31. Determine the Gram Molecular Mass or the Gram Formula Mass for $CaBr_2$.
SHOW WORK Atomic masses

Ca - 40 g/mol × 1 mol = 40 g
Br - 80 g/mol × 2 mol = 160 g
Total - GFM 200 g/mol

32. Determine the amount of grams for 5.6 moles of $C_2H_4$.
SHOW WORK Atomic Masses

C - 12 g/mol × 2 mol = 24 g
H - 1 g/mol × 4 mol = 4 g
GMM - $C_2H_4$ = 28 g/mol

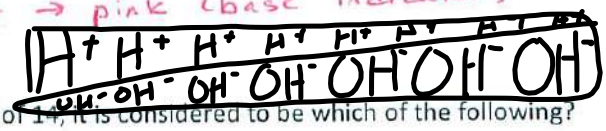
$\text{Given} \times \frac{\text{unit to be found}}{\text{unit to be canceled}} = \frac{5.6\text{ moles}}{1} \times \frac{28\text{ g}}{\text{mole}} = 156.8\text{ g } C_2H_4$

33. Determine the amount of moles for 79.3 grams of $CL_2$.
SHOW WORK Atomic Mass Cl - 35.5 g/mol × 2 mol = 71 g/mol $Cl_2$

$\frac{79.3\text{ g}}{71\text{ g/mol}} = 1.12\text{ mol } Cl_2$

$\frac{\text{Given}}{1} \times \frac{\text{unit to be found}}{\text{unit to be canceled}} = \frac{79.3\text{ g}}{1} \times \frac{1\text{ mol}}{35.5\text{ g}} = \text{\_\_\_\_ mol}$

34. Which of the following indicators turn pink when it is put into a basic solution?
a. Universal indicator different colors (acid + base indicator)
b. BTB blue → green or yellow (acid indicator)
(c) Phenolphthalein clear → pink (base indicator)
d. All of the above




35. When a substance has a pH of ~~14~~, it is considered to be which of the following?
a. Weak acid
b. Weak base
c. Strong acid
(d) Strong base

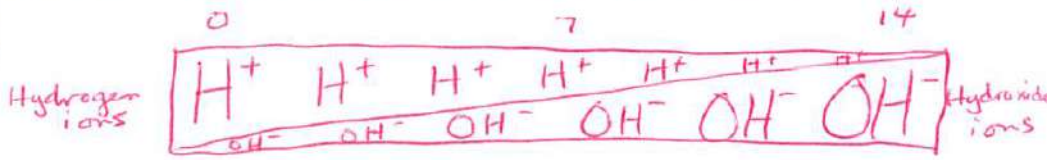
0 — 7 — 14
strong ↔ weak neutral weak ↔ strong
Acid Base

36. When a substance is neutral, it will have a pH of: MEMORIZE
a. 1
b. 3
(c) 7
d. 10

Cation = positive ion  Anion = negative ion

37. When solution has a pH of 3, which of the following ions does it have a lot dissolved in it?

a. Hydrogen ions
b. Hydroxide ions
c. Anions
d. $OH^-$ ions




38. If it takes 30 mL of 0.5 NaOH to neutralize 120 mL of an HCl solution, what is the concentration of the HCl?

Base  Acid

$(M_aV_a=M_bV_b)$ — Molarity base, Volume base

Molarity acid, Volume acid

Use Buret to neutralize acid

$M_a \times 120\,mL = 0.5M \times 30\,mL$

$M_a \times 120\,mL = 15$

$M_a = .125\,M$

39. If it takes 15 mL of 0.25 M HCl to neutralize 250 mL of NaOHsolution, what is the concentration of the NaOH solution?

$(M_aV_a=M_bV_b)$

$0.25M \times 15\,mL = M_b \times 250\,mL$

$3.75 = M_b \times 250\,mL$

$.015M = M_b$

40. List 2 government agencies that monitor the quality of our water and their acronym.

DEP - Department of Environmental Protection
FDA - Food & Drug Administration
EPA - Environmental Protection Agency
NYS DOH - New York State Department of Health

41. A) Start at a location in Upstate NY, describe the path of water being delivered to New York City.

Catskill Mountain - Reservoir → Screen, Disinfect with chlorine and add Fluorine for teeth
↓
Westchester
↓
N.Y.C.

B) Who treats the water for Scarsdale?

Reeves Newsom Water Supply Station

42. List one thing the DEP monitors and how they protect the water quality within the watersheds that supply New York City with its water.

DEP monitors Organic & Inorganic Contaminants
1) Enforce Watershed Rules & Regulations
2) Acquire & Protect watershed lands
3) Implement programs that target specific sources of pollution.

43. Toxic Metal Ions
Use the following table below.

| Ion | Concentration Six Months Ago (ppm) | Present Concentration (ppm) | EPA Limit for Freshwater Aquatic Life (ppm) | EPA Limit for Humans (ppm) |
|---|---|---|---|---|
| Arsenic (As) | 0.0002 | 0.0002 | 0.44 | 0.05 |
| Cadmium (Cd) | 0.001 | 0.001 | 0.0015 | 0.01 |
| Lead (Pb) | 0.01 | 0.02 | 0.074 | 0.05 |
| Mercury (Hg) | 0.0004 | 0.0001 | 0.0041 | 0.05 |

a) Which ions stayed the same in concentration for the past six months? Arsenic & Cadmium

b) Which ion increased in concentration for the past six months? Lead

c) What are the effects of heavy metal poisoning, such as lead and mercury, on the human body?
Lead - affects the nervous system
Mercury - affects the nervous system

44. If an element's oxidation state goes from 0 to -1 then it is considered to have undergone which of the following processes:

a. reduction
b. oxidation
c. galvanic corrosion
d. all of the above

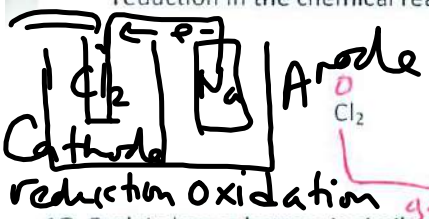
LEO the lion says GER
oxidation / lose electron
reduction / gain electron
redox - reduction and oxidation

45. How much water exists on earth in the form of freshwater?
a. 100 % b. 6% c. 3 % d. 1%

46. How much water is considered clean and unpolluted so that it is drinkable?
a. 10 % b. 6% c. .6% d. .005%

47. a) Write the oxidation states above each element in the chemical reaction below.

b) Identify which of the element is undergoing oxidation and which element is undergoing reduction in the chemical reaction below.




$2e^- + Cl_2 \rightarrow 2Cl^-$
$2Na \rightarrow 2Na^+ + 2e^-$
} Half reaction

$\overset{0}{Cl_2} + \overset{0}{Na} \rightarrow \overset{+1\ -1}{NaCl}$

Na loses e⁻ oxidation (reducing agent)

$Cl_2$ gains e⁻ reduction (oxidizing agent)

48. Explain how a battery is similar to a Voltaic cell.

Voltaic cell has cathode + anode separately while a battery has cathode + anode put together as one. Both have a reaction of oxidation (anode) and reduction (cathode)

49. Determine whether the solution is saturated, unsaturated, or supersaturated in the following statements. Use the Solubility Curves Graph

a. 60 g of $NH_4Cl$/ 100g $H_2O$ at 70°C unSaturated (below the line)

62g of $NH_4Cl$/100g $H_2O$ at 70°C Saturated (on the line)
68g of $NH_4Cl$/100g $H_2O$ at 70°C supersaturated (above the line)

b. 50 g of $KNO_3$/ 50g of $H_2O$ at 50°C = $\frac{100\text{g}}{100\text{g}}$ of $KNO_3$ supersaturated (above the line)

↑Temp Solubility of solid↑
↑Temp Solubility Gas↓

50. If a saturated solution of $NH_3$ in 100 grams of $H_2O$ at 20°C is heated to 50°C where the solution is once again saturated, how much $NH_3$ will precipitate out of the solution? SHOW WORK

$\frac{55\text{g}}{100\text{g}}$ $NH_3$ at 20°C

$\frac{28\text{g}}{100\text{g}}$ $NH_3$ at 50°C

difference 27g $NH_3$ precipitates out

51. If a solution of $NaNO_3$ contains 90 g/100g at 50°C, how much more must be added to saturate the solution? SHOW WORK

$\frac{90\text{ g}}{100\text{g}}$ $NaNO_3$ at 50°C

115g − 90g = 25g must be added

$\frac{115\text{ g}}{100\text{g}}$ $NaNO_3$ at 50°C saturated

52. What is the concentration in parts per hundred of a solution that has 35 grams of NaCl getting dissolved into 65 grams of $H_2O$? (This is also the percent concentration)

SHOW WORK

$\frac{\text{solute}}{\text{solution}} = \frac{35\text{g}}{35\text{g}+65\text{g}} = \frac{35\text{g}}{100\text{g}}$

$\frac{35\text{g}}{100\text{g}} \times 100 = 35\%$ or 35 pph

53. What is the concentration of the solution that has 75 g of KI dissolved into 25 g of $H_2O$ in parts per hundred and parts per million? SHOW WORK

$\frac{75g}{75g+25g} = \frac{75g}{100g} = 75$ pph

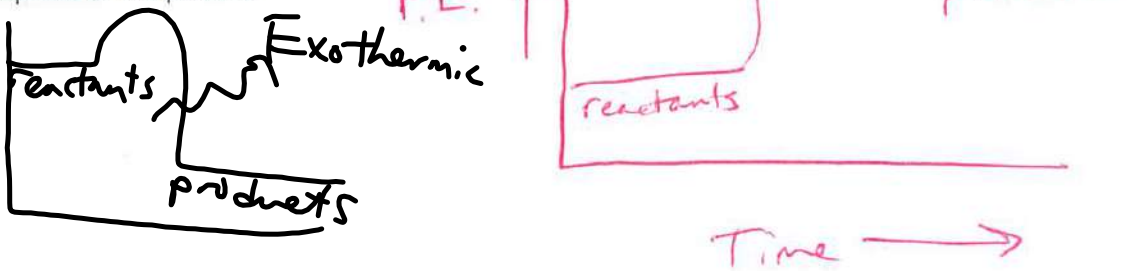
$\frac{75g}{100g} = \frac{x}{1,000,000g}$ $x = 750,000$ ppm

54. Energy due to motion is called:

a. Potential energy
b. Kinetic energy
c. Bond energy
d. Heat energy

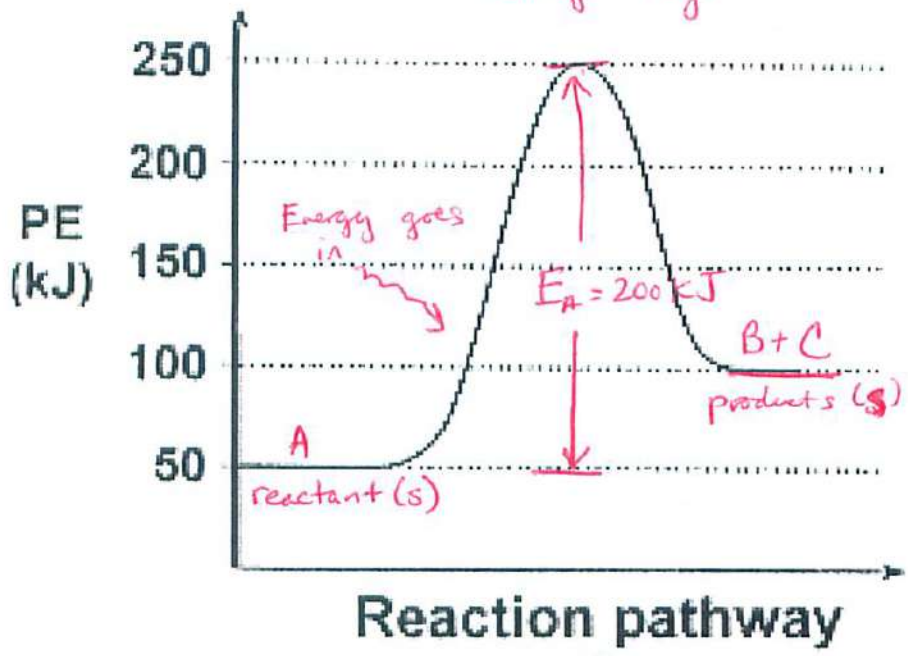
55. For an endothermic process, the reactants are of _____ potential energy (than/as) the products.

a. Higher
b. Lower
c. The same
d. Depends on the process



56. Analyze the following Potential Energy diagram.

Graphing




A + 50 kJ → B + C

Answer the following short answer questions based on the Potential Energy diagram.

a) Does the graph represent an exothermic or endothermic reaction?

Endothermic

b) Determine ΔH for this reaction. Products energy − Reactants energy =

50 kJ

c) Determine the Activation energy = $E_{act}$ for this reaction.

Highest point − Reactants energy =

200 kJ

57. If 3770g of water is heated from 22.0 °C to 88.0 °C, how much heat energy in joules is absorbed? (specific heat of water = 4.184 J/g°C)

$Q = mc\Delta T$

$Q = 3770g \times 4.184 J/g°C \times (110°C - 22°C)$

$= 3770g \times 4.184 J/g°C \times (88°C)$

$= 1,388,083.84 J$

$= 1,388 kJ$

1000 J = 1 KJ

58. Nuclear equations show transmutations of one kind of nucleus into another. Complete and balance the equations for the following nuclear transmutations.

a. $^{14}_{6}C \rightarrow {}^{14}_{7}N + {}^{0}_{-1}\beta$ or $^{0}_{-1}e$

b. $^{230}_{88}Th \rightarrow {}^{4}_{2}He + {}^{226}_{86}Rn$

59. What mass of I-131 remains from a 60 g sample after 40 days? Half-Life is 8 days. SHOW WORK

Given I-131 - half-life 8.07 days

Original amount = 60 g

Total time

$\frac{\text{Total time}}{\text{Half-life}} = \#$ of half-lives

$\frac{40 \text{ days}}{8 \text{ days}} = 5$ half-lives

60g ① 30g ② 15g ③ 7.5g ④ 3.75g ⑤ 1.875g

60. The half-life of radioisotope is 15 days. What mass remains from a 100 g sample after 45 days?

SHOW WORK Half-life = 15 days

Original amount = 100g

Total time = 45 days

$\frac{45 \text{ days}}{15 \text{ days}} = 3$ half-lives

100g ① 50g ② 25g ③ 12.5g

61. A device for controlling nuclear fission and creating energy is known as a Nuclear Power Plant.

62. Control Rods regulate the number of neutrons available by absorbing them.

63. In order to generate electricity within a nuclear power plant, steam rotates a Turbine.

64. How could we define a resource? Something that we use

65. a) What is a **nonrenewable** resource? A resource that is limited and cannot be made again

b) Name two nonrenewable resources. Oil

Trees

66. a) What is a renewable resource? Something that can be made again or unlimited supply

b) Name two renewable resources. Sun, Wind, Water

Solar Wind Hydropower

Geothermal

67. Describe a Nuclear Power Plant. Compare and contrast it with a sustainable energy power producing plant. List the positives vs. the negatives between the two energy producing plants.

Nuclear Power Plant produces energy from nuclear fission ex. Uranium-238

negatives - produces radioactive waste, nuclear meltdown, can occur

positives - thermal pollution (heating of nearby lakes or streams) provides a lot of energy, it doesn't use up radioactive material too quickly

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Solar Energy produces energy from capturing solar rays

negatives - it isn't always reliable, it must be located in sunny areas, it is expensive

positives - it is not appealing, it is sustainable, it doesn't produce wastes or no pollution

68. Identify each of the pieces of equipment below and its purpose.

Erlenmeyer flask

Beaker

Graduated Cylinder

Buret