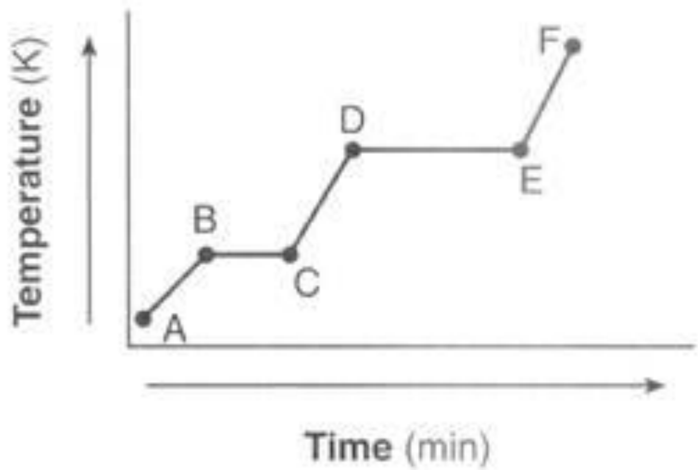
Regents Chemistry Students

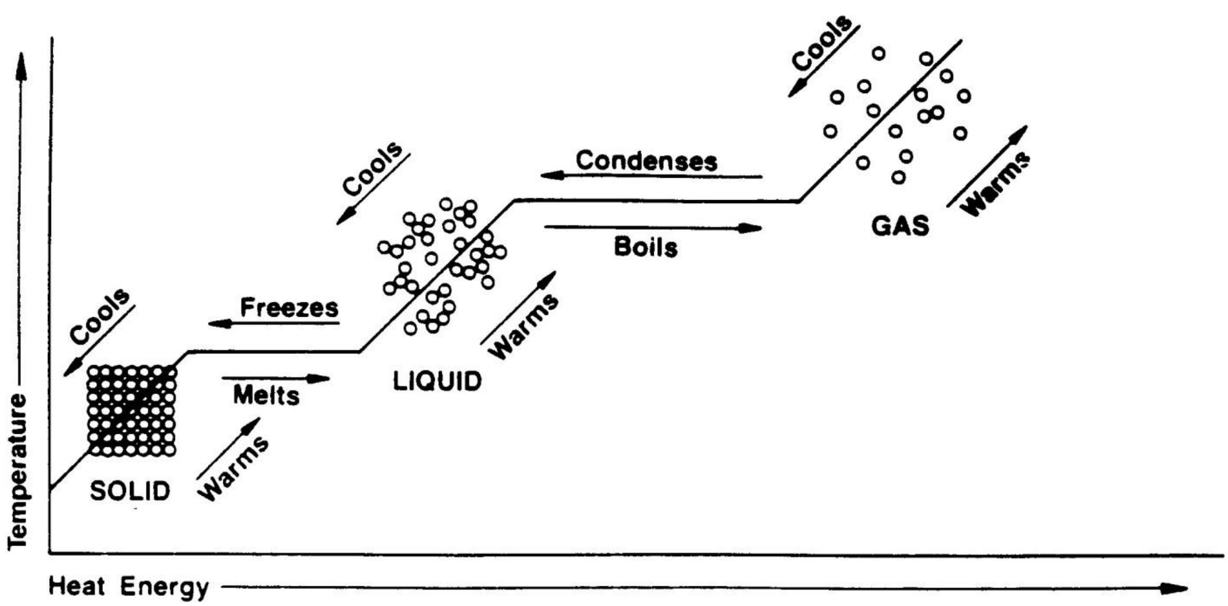
1. Please watch the unit 1 Review video posted on youtube in Carla Parkes Regents review playlist

   https://www.youtube.com/watch?v=_RmgPnBZv5g&list=PL3oGXoJXQ1DJDjtUBDOSJibTrwmh_ckAX

2. As you watch the video complete the note packet.
3. Log on to Castle learning https://cl.castlelearning.com/review/clo/account/logon/ and complete the Review #1 Matter and Energy. If you have forgotten your login (it's usually nf.first initial middle initial last name) contact your teacher: ryots@nfschools.net, cciccone@nfschools.net, or cparkes@nfschools.net
4. Watch the Unit 2 Review video posted on youtube in Carla Parkes Regents review playlist https://www.youtube.com/watch?v=cbgPgAarCMA&list=PL3oGXoJXQ1DJDjtUBDOSJibTrwmh_ckAX&index=3&t=0s
5. As you watch the video complete the note packet.
6. Log on to Castle learning https://cl.castlelearning.com/review/clo/account/logon/ and complete the Review #2 Atoms. If you have forgotten your login (it's usually nf.first initial middle initial last name) contact your teacher: ryots@nfschools.net, cciccone@nfschools.net, or cparkes@nfschools.net
7. Watch the unit 3 review video posted on youtube in Carla Parkes Regents review playlist https://www.youtube.com/watch?v=oYEylCMh9E4&list=PL3oGXoJXQ1DJDjtUBDOSJibTrwmh_ckAX&index=3
8. Log on to Castle learning https://cl.castlelearning.com/review/clo/account/logon/ and complete the Review #3 Nuclear Chemistry. If you have forgotten your login (it's usually nf.first initial middle initial last name) contact your teacher: ryots@nfschools.net, cciccone@nfschools.net, or cparkes@nfschools.net

Review #1 Notes: Heating and Cooling Curves, Energy Calculations, Names of Phase Changes





Calculating Heat Energy

Table T
Important Formulas and Equations

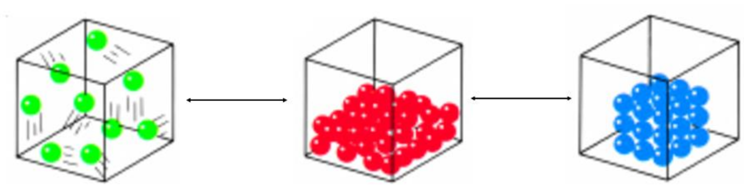
Heat	$q = mC\Delta T$ $q = mH_f$ $q = mH_v$	q = heat m = mass C = specific heat capacity ΔT = change in temperature	H_f = heat of fusion H_v = heat of vaporization

Table B
Physical Constants for Water

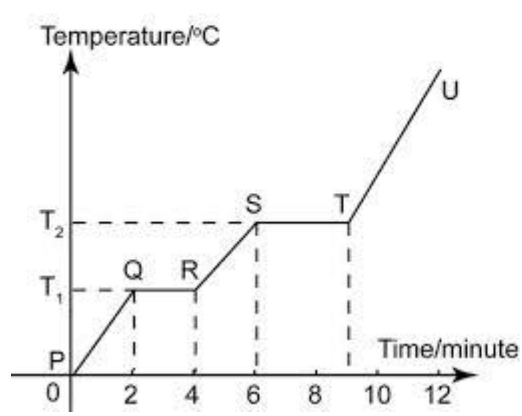
Heat of Fusion	334 J/g
Heat of Vaporization	2260 J/g
Specific Heat Capacity of H_2O (ℓ)	4.18 J/g•°C

<u>States of Matter</u>

- How can matter change from one state to another?



- Temperature =
- A temperature increase = a kinetic energy ___________
- Kinetic Energy = Potential Energy =
- Remember – energy must be conserved – it cannot be created or destroyed!
  - If we add heat energy, either the kinetic or potential energy of molecules must change
    - If kinetic energy ↑, what must potential energy do? _____



If heat is added at a constant rate of 500 J/min, find each of the following:

a. The heat of fusion.
b. The heat of vaporization.

Review #2- Atomic theories, parts, isotopes, calculating average isotopic mass

Early Greeks, like Democritus thought that all matter was made of atoms and atoms were hard, indivisible spheres- like marbles

Daltons Atomic Theory:

1. Matter is made of atoms
2. Atoms are indivisible*
3. Atoms of the same element are identical and atoms of different elements are different*
4. Compounds are chemical combinations of elements.
5. Chemical reactions are just rearrangements of atoms. (matter is not created nor destroyed

* These parts of this theory we know now to be false. Atoms have parts (p,n,e) and atoms of the same element can have a different number of neutrons (different mass)- also known as isotopes.

JJ Thompson discovered that atoms were made of negative parts he called electrons and since all atoms were neutral he said that there must also be positive stuff in an atom. He described atoms like "**plum pudding**"….or what I call a chocolate chip cookie model of the atom…with the dough a positive goop and the chocolate chips negative electrons embedded in it. He was the first scientist to discover that atoms had parts.

Earnest Rutherford and his famous Gold Foil Experiments:

He bombarded thin gold foil with alpha particles (+ radiation)

He noticed most passed right through the foil but a few were deflected back toward the source.

He determined that since most passed through atoms are mostly empty space and that since a few were deflected atoms have a dense positively (+) charged nucleus.

He discovered atoms have a nucleus and revised the Plum Pudding Model of the atom to the nuclear model of the atom!

Neils Bohr created the **planetary model of the atom** that stated that electrons orbit the nucleus like planets orbiting the sun. He also realized that electrons can be made to move to higher energy levels away from the nucleus by adding specific packages of energy called- quanta. When an electron absorbs energy and moves away from the nucleus it is in the excited state. This is unstable and it will return back down to its original position (lower energy levels) called the ground state. When electrons return to the ground state they produce energy we see as light- also known as a bright line spectrum.

Wave- Mechanical Model- or Modern Model of the Atom

Our modern model of the atom was created by many scientists over a long period of time. Atoms have a nucleus that contains protons and neutrons and electrons live outside the nucleus in orbitals. BUT….. An orbital is NOT a specific pathway that an electron follows! An orbital or electron cloud is a region around the nucleus where there is a good chance of finding an electron!

Atoms- no charge

Protons= atomic number

Neutrons= mass- atomic number

Electrons= protons

Atoms become ions by losing electrons

Atoms become ions by gaining electrons

Ions- have a charge

+ ions: Cations
Protons= atomic number
Neutrons= mass- atomic number
Electrons= protons- charge

-ions: Anions
Protons= atomic number
Neutrons= mass-atomic number
Electrons= protons + charge

Reference Table O provides the mass and charge of a Proton, neutron, and electron (beta particle).

Table O
Symbols Used in Nuclear Chemistry

Name	Notation	Symbol
alpha particle	${}^{4}_{2}He$ or ${}^{4}_{2}\alpha$	α
beta particle (electron)	${}^{0}_{-1}e$ or ${}^{0}_{-1}\beta$	β^-
gamma radiation	${}^{0}_{0}\gamma$	γ
neutron	${}^{1}_{0}n$	n
proton	${}^{1}_{1}H$ or ${}^{1}_{1}p$	p
positron	${}^{0}_{+1}e$ or ${}^{0}_{+1}\beta$	β^+

Other Important Stuff:

1. **Nuclear Charge**: charge of the nucleus. Equal to the number of protons. For example the nuclear charge of oxygen is 8.
2. **Isotopes**: atoms of the same element with the same number of protons but a different number of neutrons. Same atomic mass but different atomic number. C-12 and C-14.
3. **Electron Configuration:** found under the atomic number on the periodic table. Provides the location and number of electrons in energy levels outside the nucleus. For example Carbon's electron configuration is 2-4. This means in the first energy level there are 2 electrons and in the second energy level there are 4!
4. **Ground State vs. Excited State:** All the electron configurations given on the periodic table are ground state configurations. To be in the excited state means one or more of the atoms electrons have jumped to higher energy levels. So….. if carbon's ground state is 2-4 then the excited state might be 2-3-1. (same number of electrons but one has jumped into the third energy level)
5. **Valence Electrons and Lewis Dot Diagrams-** valence electrons are the electrons in the outermost energy level of an atom- the last number in the electron configuration…for carbon its 4. Lewis Dot Diagrams only show valence electrons.
6. **Calculating Average Isotopic (Atomic) Mass:**
   1. Convert % abundance to decimal by dividing by 100.
   2. Multiply decimal by the mass of the isotope
   3. Add the values together.

The atomic masses and the natural abundances of the two naturally occurring isotopes of lithium are shown in the table below.

Lithium Isotopes

Isotope	Atomic Mass (u)	Natural Abundance (%)
Li-6	6.02	7.5
Li-7	7.02	92.5

Which numerical setup can be used to determine the atomic mass of lithium?

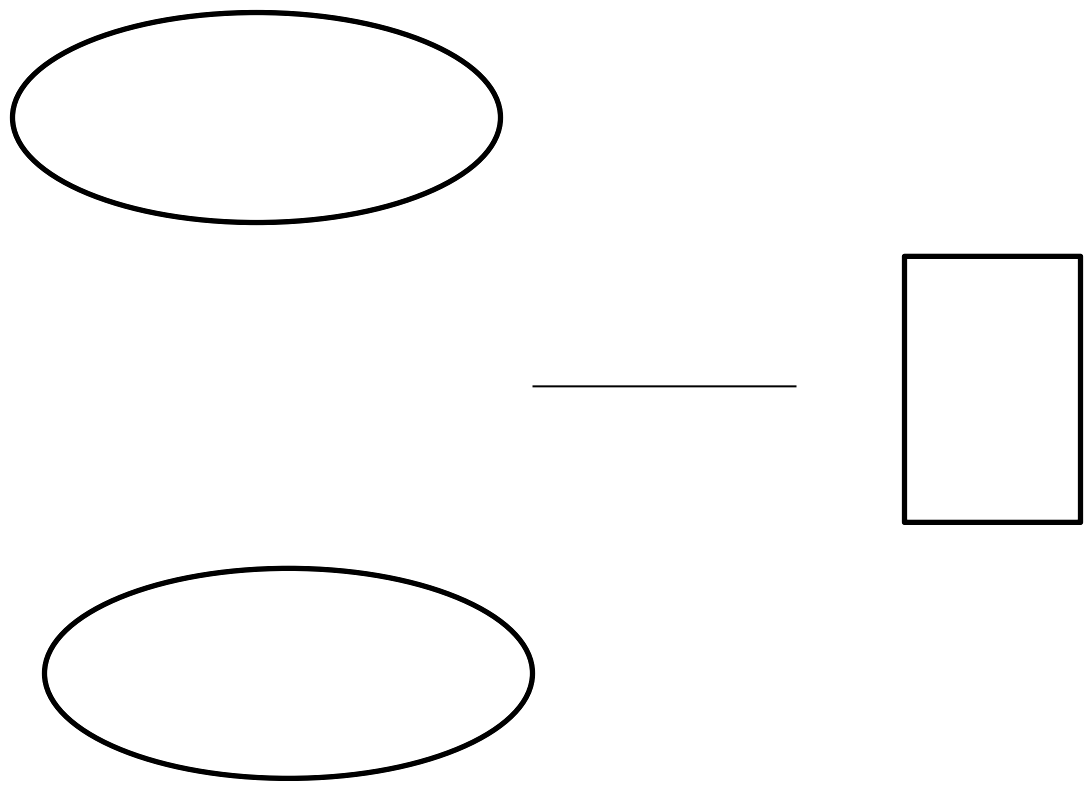
1. (0.075)(6.02 u) + (0.925)(7.02 u)
2. (0.925)(6.02 u) + (0.075)(7.02 u)
3. (7.5)(6.02 u) + (92.5)(7.02 u)
4. (92.5)(6.02 u) + (7.5)(7.02 u)

Review #3- Nuclear Chemistry Review

PART 1: Half-life Problems

Half-Life is the amount of time it takes for one-half of a radioactive isotope to decay (transmutate). Half-Life is a constant and is found on Table N for several radioactive isotopes.

Solving Half-life Problems



******IF FRACTIONS ARE INVOLVED USE 1 AS ORIGINAL MASS*****

1. What fraction of a Sr-90 sample remains unchanged after 87.3 years?

2. After decaying for 48 hours, $\frac{1}{16}$ of the original mass of a radioisotope sample remains unchanged. What is the half-life of this radioisotope?

Part 2: Nuclear Reactions: Involve the conversion of mass to energy- resulting in large exothermic reactions (3 billion times more energy than an ordinary chemical reaction)

1. FI**SS**ION- involves **splitting** of a heavy nucleus into lighter nuclei. Look for neutrons on both sides and either U or Pu as a reactant. Pro- Lots of energy. Con- radioactive waste.

   $^{1}_{0}n + ^{239}_{94}Pu \rightarrow X + ^{94}_{36}Kr + 2\,^{1}_{0}n$ or $^{1}_{0}n + ^{235}_{92}U \rightarrow ^{141}_{56}Ba + ^{92}_{36}Kr + 3\,^{1}_{0}n$

2. F**U**SION- involves **Uniting** light nuclei into something heavier. Look for hydrogens or heliums combining. Pro- no radioactive waste. Con- requires extreme amount of heat and pressure to occur. Occurs naturally in the sun.

   $^{2}_{1}H + ^{2}_{1}H \rightarrow ^{4}_{2}He$

3. Natural Transmutation- One element turns into another through the release of radiation- Look for only one reactant!

   $^{3}_{1}H \rightarrow ^{3}_{2}He + ^{0}_{-1}e$ or $^{14}_{6}C \rightarrow ^{14}_{7}N + ^{0}_{-1}e$

4. Artificial Transmutation- We force one element to turn into another through the release of radiation. Look for two reactants!

   $^{10}_{5}B + ^{4}_{2}He \rightarrow ^{13}_{7}N + ^{1}_{0}n$ or $^{27}_{13}Al + ^{4}_{2}He \rightarrow ^{30}_{15}P + ^{1}_{0}n$

Part 3: Stable and Unstable Isotopes: any element with an atomic number of 83 or higher has NO STABLE isotopes. This means it is only radioactive. Any element below 83 can have both stable (non-radioactive) nuclei or unstable (radioactive) nuclei. Typically a proton to neutron ratio of 1:1 is stable.

Part 4: Writing Nuclear Reactions or Fill in the Missing Particle: The key to these problems is to make the total mass on the left equal to the total mass on the right and same with atomic number!

Use Table N to write decay reactions for

1. The alpha decay of Pu-239

2. The beta decay of Cs-137

3. The positron emission of Fe-53

$$\_\_\_\_\_\_ \rightarrow {}^{4}_{2}He + {}^{206}_{82}Pb$$

$${}^{137}_{55}Cs \rightarrow {}^{0}_{-1}e + \_\_\_\_\_\_$$

Part 5: Uses of Isotopes

C-14- used to date once living things and used as a tracer in organic pathways

Co-60- used to treat cancer and irradiate food

I-131- used to diagnose thyroid disorders

U-238- used to date rocks

Tc-99- used to diagnose brain tumors.

Part 6: Radioactive particles:

Particle	Symbol	If ejected the atomic mass	If ejected the atomic number	Penetrating power
Alpha		decreases by 4	Decreases by 2	Weak
Beta		Stays the same	Increases by 1	Moderate
Positron		Stays the same	Decreases by 1	Moderate
Gamma		Stays the same	Stays the Same	High