Announcements

To join clicker to class today (Clickers with LCD display join automatically):

- Turn on the Clicker (the red LED comes on).
- Push "Join" button followed by "20" followed by the "Send" button (switches to flashing green LED if successful).

- Still not signed up for e-mail discussion list: Burt,M.; Fuller,T.;Graul,A.; Hawramy,H.; Hudson,J. ; James,A. ; Jones,B. ; Kalmerton,K. ; Kieffer,M. ; Peterson,D. ; Wienkes,M. ; Yang,M.
- Exam Wed. To speed getting started do not enter class until I let you in.
- All review material on class web site.
- Next section reading and problems will be posted on Wednesday.

Review

- Fission reactions.
  - $^{239}_{93}Np + {}^{1}_{0}n \rightarrow {}^{142}_{56}Ba + 4{}^{1}_{0}n + {}^{94}_{37}Rb$,
  - Chain reactions – Releases energy
  - Nuclear reactors.
- Making artificial isotopes by fusion of nuclides using accelerators.
- Measuring radioactivity
  - Units: counts/s & Ci = 3.7×10^{10} counts/s
  - Measure with film or Geiger Counter.
- Biological effects—ionizing radiation damages by ionizing molecules and breaks them into reactive fragments.
- Effects of α, β and γ different.

Uranium/Radon Decay

Chang Table 21.3

Relative abundance of Elements

See also Chang
Table 21.2

Radioactive Dating

- Expression for fraction left at time, t: $\frac{A_t}{A_0} = 0.5^{(t/t_{1/2})}$
- Solving for t: $t = t_{1/2} \cdot \ln(A_t/A_o)/\ln(0.5)$
- Carbon Dating
  - Use $^{14}C/^{12}C$ ratio for A_t and A_o
  - Use new sample to get A_o
- Other isotopes: A_o=stable product + remaining radionuclide; A_t= remaining radionuclide.

Exam 1 Review

- states of matter (solid, liquid, gas + micro and macro view)
- Mixtures (separable by physical processes-filtration and evaporation/distillation).
- Pure substances (not separable into components by physical means).
- Pure vs. mixtures.
- Chemical vs physical properties.
- Elements, atoms, compounds.
- Scientific process (hypothesis, theory, testability, constant change).
- light is a wave $c=\upsilon\lambda \Rightarrow \upsilon=c/\lambda$ or $\lambda=c/\upsilon$.
- remember metric prefixes.
- Universe is expanding, know because of Doppler effect.

Exam 1 Review

- Doppler effect • Red Shift => expansion
- Expansion of universe/Big Bang
  - energy->quarks->n -> p + e -> nucleons -> atoms -> stars/galaxies
- radioactive decay
- Isotopes (average atomic mass)
- Temperature is a measure of the average kinetic energy of the particles in a sample. (also conversion between different units)
- Fusion in stars produces elements larger than H and He.
- Fusion stops at $^{56}_{26}Fe$ because heavier nuclei have lower nuclear binding energy per nucleon.

Exam 1 Review

- Radioactive decay
  - above band of stability undergo β-decay
  - below undergo e^--capture or e^+-emission ($^{+1}_{0}e$), beyond undergo α-decay.
- Can get to Bi by n-capture and β-decay.
- Heavier than Bi, produced by rapid n-capture in supernovas.
- Common kinds of radioactive decay α and fission.
- Fission reactions.
  - $^{239}_{93}Np + {}^{1}_{0}n \rightarrow {}^{142}_{56}Ba + 4{}^{1}_{0}n + {}^{94}_{37}Rb$,
  - Chain reactions – Releases energy
  - Nuclear reactors.
- Making artificial isotopes by fusion of nuclides using accelerators.

Exam 1 Review

- Measuring radioactivity
  - Units: counts/s & Ci = 3.7 x 10^{10} counts/s
  - Measure with film or Geiger Counter.
- Biological effects—ionizing radiation damages by ionizing molecules and breaks them into reactive fragments.
- Effects of α, β and γ different.
  - α is the most damaging, but least penetrating.
- Hazards of Rn
- Used medically for imaging and to kill cancerous cells.