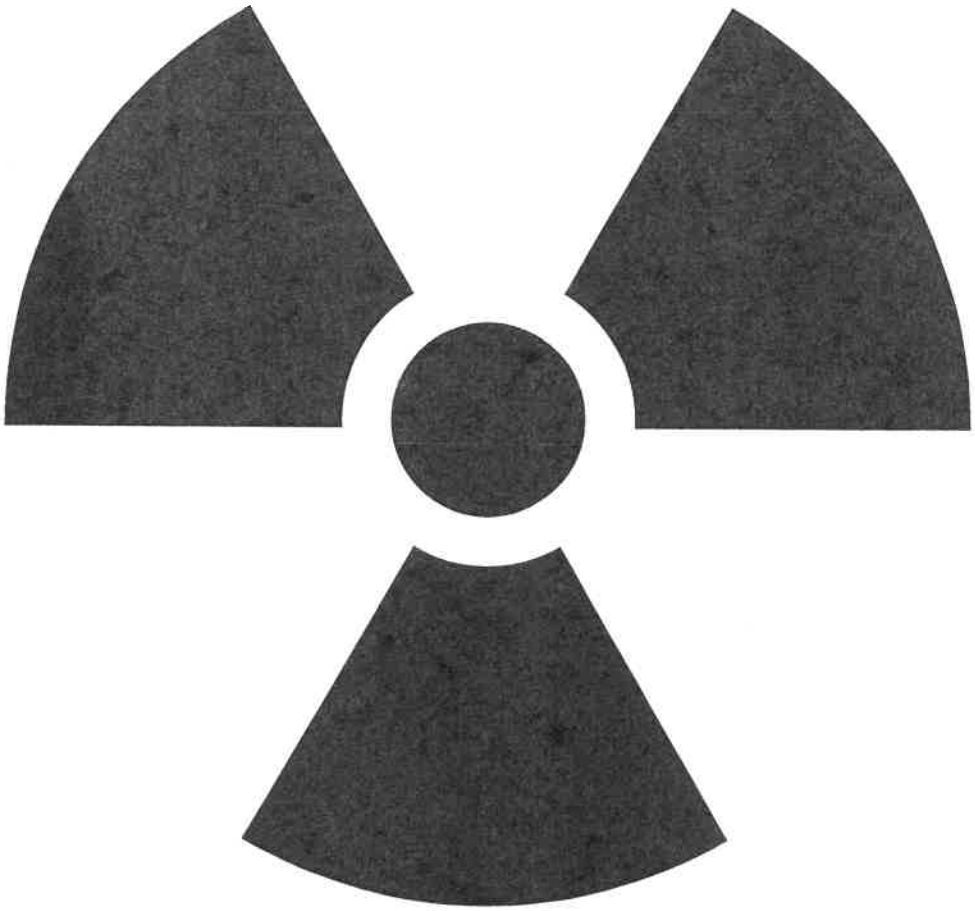
Nuclear Chemistry



NOTES

Chemical rxns occur b/c electrons are transferred or shared.

today is the 1 day we will talk about changing protons + neutrons.

Changing protons + neutrons is a BIG deal

b/c large amounts of energy are produced.

** fission - nucleus splits - power plants, Atomic Bomb
fusion - nuclei fuse - stars, H bombs

Radioactivity - process of an unstable nucleus emitting one or more particles + electromagnetic radiation energy.

= too many protons or neutrons make unstable

= Actinides

Balance nuclear equations

- mass can't be created or destroyed
- Blank gets a "particle" or element

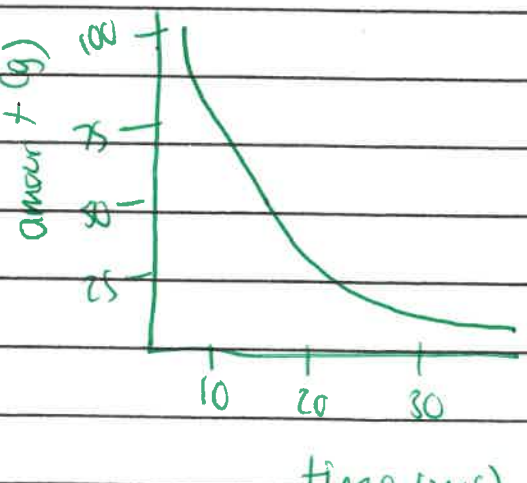
NOTES

$^{1}_{1}p$	proton
$^{1}_{0}n$	neutron
$^{4}_{2}He$ $^{4}_{2}\alpha$	alpha
$^{0}_{-1}e$ $^{0}_{-1}\beta$	beta * fast moving electron *
$^{0}_{0}\gamma$	gamma similar to xrays
$^{0}_{+1}e^{*}$	positron

half life - time it takes for ½ of a sample to decay
- cut in half

$$n = \frac{TT}{\frac{1}{2}}$$

# of divisions



NOTES

NOTES

Half Life—Practice problems (level 1) Name: _____

1. A piece of Uranium 238 weighs 1.000kg. How much of this isotope will remain about 36×10^9 years if the half life for U-238 is 4.5×10^9 years.

2. Polonium 218 has a half life of 3.0 minutes. A sample weighing 50.0g is stored on a laboratory shelf. How much of this isotope will remain after 15 minutes have passed?

3. A certain rock sample is found to contain 35g of the radioactive isotope, technetium 99. How much f the isotope will remain in the rock after a period of 1,000,000 years if the half life is 2.0×10^5 years?

4. A block of radium 226 weighs ~~1.0x 104~~ 1.0×10^4 kg. How much of this radioactive isotope will remain after 6500 years have passed if the half life is 1620 years?

5. How long will it take a piece of strontium 90, weighing exactly 1.000kg, to be reduced to only 10.0 grams? The half life of Strontium 90 is 28.8 years.

6. A sample of cesium 138 is produced in a laboratory. The sample weighs 100.0g at the time is it is produced. How long will it take before this sample is reduced to only 20.0g? The half life of Cesium 138 is 32.2 minutes.

7. A hospital purchases 80.0kg of cobalt 60 to use in cancer therapy. How long will it be before there remains only 15kg of this isotope? The half life o f Co-60 is 5.26 years.

8. A sample of oxygen gas contained within a glass tube includes 7.4 g of the isotope oxygen-15. At what later time will the amount of oxygen 15 be reduced only to 0.5g? The half life of 0-15 is 1.97 minutes.

Half-Life and Radioactive Isotopes

1. How much of a 100.0 g sample of Au-198 is left after 8.10 days. The half-life of Au-198 is 2.70 days.

2. The half-life of K-42 is 12.4 hours. How much of a 750 g sample is left after 62.0 hours?

3. The half-life of Th-232 is 1.4×10^{10} years. If there are 25.0 g of the sample left after 2.8×10^{10} years, how many grams were in the original sample?

4. There are 5.0 g of I-131 left after 40.35 days. How many grams were in the original sample if its half-life is 8.07 days?

5. What is the half-life of Tc-99 if a 500 g sample decays to 62.5 g in 639,000 years?

6. A 50.0 g sample of N-16 decays to 12.5 g in 14.4 seconds. What is its half life?

Name_____ Per _____

Nuclear decay

Fill in the blanks to complete the following nuclear reactions. Use a periodic table.

1. $^{42}_{19}K \rightarrow {}^{0}_{-1}e +$ _____

2. $^{239}_{\ }Pu \rightarrow {}^{4}_{2}He +$ _____

3. $^{235}_{92}U \rightarrow$ _____ $+ {}^{231}_{90}Th$

4. $^{1}_{1}H + {}^{3}_{1}H \rightarrow$ _____

5. $^{6}_{3}Li + {}^{1}_{0}n \rightarrow {}^{0}_{-1}e\ {}^{4}_{2}He +$ _____

6. $^{27}_{13}Al + {}^{4}_{2}He \rightarrow {}^{30}_{15}P +$ _____

7. $^{9}_{4}Be + {}^{1}_{1}H \rightarrow$ _____ $+ {}^{4}_{2}He$

8. $^{37}_{\ }K \rightarrow {}^{0}_{+1}e +$ _____

9. _____ $+ {}^{1}_{0}n \rightarrow {}^{142}_{56}Ba + {}^{91}_{36}Kr + 3\,{}^{1}_{0}n$

10. $^{238}_{92}U + {}^{4}_{2}He \rightarrow$ _____ $+ {}^{1}_{0}n$

11. $^{99}_{43}Tc \rightarrow$ _____ $+ {}^{0}_{-1}e$

12. $^{226}_{88}Ra \rightarrow {}^{4}_{2}He +$ _____

13. _____ $\rightarrow {}^{4}_{2}He + {}^{208}_{81}Tl$

14. $^{27}_{13}Al +$ _____ $\rightarrow {}^{24}_{11}Na + {}^{4}_{2}He$

15. $^{235}_{92}U + {}^{1}_{0}n \rightarrow 3\,{}^{1}_{0}n + {}^{139}_{56}Ba +$ _____

16. $^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{139}_{53}I + 2\,{}^{1}_{0}n +$ _____

17. $^{241}_{95}Am + {}^{4}_{2}He \rightarrow 2\,{}^{1}_{0}n +$ _____

18. $^{214}_{84}Po + 2\,{}^{4}_{2}He + 2\,{}^{0}_{-1}e \rightarrow$ _____

Nuclear Chemistry

I. Complete the following nuclear reactions:

1. $^{27}_{13}Al + {}^{4}_{2}He \rightarrow {}^{30}_{15}P +$ _____

2. $^{63}_{29}Cu + {}^{2}_{1}H \rightarrow 2{}^{1}_{0}n +$ _____

3. $^{44}_{20}Ca + {}^{1}_{1}H \rightarrow {}^{44}_{21}Sc +$ _____

4. $^{9}_{4}Be + {}^{4}_{2}He \rightarrow {}^{12}_{6}C +$ _____

5. $^{31}_{15}P + {}^{2}_{1}H \rightarrow {}^{32}_{15}P +$ _____

6. $^{37}_{17}Cl +$ _____ $\rightarrow {}^{35}_{16}S + {}^{4}_{2}He$

7. $^{30}_{15}P +$ _____ $\rightarrow {}^{30}_{14}Si + {}^{1}_{1}H$

8. $^{2}_{1}H + {}^{2}_{1}H \rightarrow {}^{1}_{1}H +$ _____

9. $^{11}_{5}B + {}^{4}_{2}He \rightarrow {}^{14}_{7}N +$ _____

10. $^{63}_{29}Cu + {}^{2}_{1}H \rightarrow {}^{64}_{30}Zn +$ _____

11. $^{2}_{1}H +$ _____ $\rightarrow {}^{1}_{1}H + {}^{1}_{0}n$

12. $^{31}_{15}P + {}^{1}_{1}H \rightarrow {}^{28}_{14}Si +$ _____

13. $^{14}_{7}N +$ _____ $\rightarrow {}^{17}_{8}O + {}^{1}_{1}H$

14. $^{239}_{94}Pu + {}^{4}_{2}He \rightarrow {}^{1}_{0}n +$ _____

(continued)

15. $^{63}_{29}Cu + {}^{1}_{1}H \rightarrow {}^{38}_{17}Cl + {}^{1}_{0}n +$ _____

16. $^{63}_{29}Cu + {}^{2}_{1}H \rightarrow {}^{64}_{29}Cu +$ _____

17. $^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{95}_{42}Mo + 2{}^{1}_{0}n +$ _____

18. $^{6}_{3}Li + {}^{2}_{1}H \rightarrow {}^{7}_{4}Be +$ _____

19. $^{3}_{1}H \rightarrow {}^{3}_{2}He +$ _____

20. $^{6}_{3}Li + {}^{1}_{0}n \rightarrow {}^{4}_{2}He +$ _____

21. $^{122}_{51}Sb + {}^{1}_{0}n \rightarrow {}^{122}_{51}Sb +$ _____

22. $^{214}_{82}Pb \rightarrow {}^{0}_{-1}e +$ _____

23. $^{63}_{29}Cu + {}^{2}_{1}H \rightarrow {}^{3}_{1}H +$ _____

24. $^{14}_{7}N +$ _____ $\rightarrow {}^{14}_{6}C + {}^{1}_{1}H$

25. $^{6}_{3}Li + {}^{1}_{1}H \rightarrow {}^{4}_{2}He +$ _____

26. _____ $\rightarrow {}^{237}_{93}Np + \alpha$

27. $^{2}_{1}H + {}^{2}_{1}H \rightarrow {}^{3}_{2}He +$ _____

28. $^{28}_{14}Si + {}^{2}_{1}H \rightarrow {}^{29}_{14}Si +$ _____

29. $^{9}_{4}Be + {}^{4}_{2}He \rightarrow {}^{6}_{3}Li +$ _____

30. $^{59}_{27}Co + {}^{1}_{0}n \rightarrow {}^{60}_{27}Co +$ _____

(continued)