20. 5.00 grams of He and 5.00 grams of Ar are placed in a 23.0 L flask at 7.00 atm.

a. What is the partial pressure of each gas?

$5.00\text{ g He} \times \frac{1\text{ mol}}{4\text{ g}} = 1.25\text{ mol He}$

$5.00\text{ g Ar} \times \frac{1\text{ mol}}{39.9\text{ g}} = 0.125\text{ mol Ar}$

1.375 mol total

$P_{He} = \left(\frac{1.25}{1.375}\right) 7.00 =$ → He: 6.36 atm

$P_{Ar} = \left(\frac{0.125}{1.375}\right) 7.00 =$ → Ar: 0.636 atm

b. What is the temperature of the mixture, in °C?

$P = 7.00$ atm
$V = 23.0$ L
$n = 1.375$ mol
$T = ?$ K

$PV = nRT$

$(7.00)(23.0) = (1.375)(0.0821)T$

$T = 1426\text{ K} - 273 =$

Ans: 1153 °C

c. Which gas is moving faster? the lighter one... He (use Graham's Law)

21. H_2 and O_2 are in the same flask. If the H_2 is moving at 755 mph, how fast is the O_2 moving?

$mv^2 = mv^2$ $\quad 2(755^2) = 32(v^2)$ $\quad v = 189$ mph

Packet 6

22. ${}^{6}_{3}Li + {}^{12}_{6}C \rightarrow {}^{17}_{9}F + {}^{1}_{0}n$ neutron (particle name) fusion (type of reaction)

23. ${}^{233}_{92}U \rightarrow {}^{4}_{2}He^{+2} + {}^{229}_{90}Th$ uranium-233 (particle name) natural decay (type of reaction)

24. How much of a 140 g sample of lead will remain after 72 years, given that its half-life is 22 years?

$72\text{ yrs} = (22\text{ yrs})(n)$

$n = 3.27$

$\frac{140}{2^{3.27}} = 14.5$ → 15 g

25. If a newly cut piece of wood gives a C-14 Geiger tube reading of 215 cpm, and an artifact gives a reading of 68 cpm, how old is the artifact?

$\frac{215}{2^n} = 68$

$n = 1.66$

$T = (5730\text{ yrs})(1.66)$

$= 9510$ yrs

$J = kg \cdot (m/s)^2$
$\Delta E = \Delta mc^2$
$c = 3.00 \times 10^8$ m/s

$^{A}_{Z}X$

Table 20.3 Masses of Some Nuclei and Other Atomic Particles*

Symbol	Z	A	Mass (amu)	Symbol	Z	A	Mass (amu)
e^-	−1	0	0.000549	Co	27	59	58.9184
n	0	1	1.00867	Ni	28	58	57.9199
H or p	1	1	1.00728	Pb	82	206	205.9295
	1	2	2.01345		82	207	206.9309
	1	3	3.01550		82	208	207.9316
He	2	3	3.01493	Po	84	210	209.9368
	2	4	4.00150		84	218	217.9628
Li	3	6	6.01347	Rn	86	222	221.9703
	3	7	7.01435	Ra	88	226	225.9771
Be	4	9	9.00999	Th	90	230	229.9837
B	5	10	10.0102		90	234	233.9942
	5	11	11.0066	Pa	91	234	233.9931
C	6	12	11.9967	U	92	233	232.9890
	6	13	13.0001		92	234	233.9904
O	8	16	15.9905		92	235	234.9934
Cr	24	52	51.9273		92	238	238.0003
Fe	26	56	55.9206	Pu	94	239	239.0006

*The mass of an atom is obtained by adding the masses of the electrons to the nuclear mass given in thi table. For example, the mass of the $^{12}_{6}C$ atom is 11.9967 + 6(0.000549) = 12.0000. (From R. C. Weas ed., *CRC Handbook of Chemistry and Physics*, 59th ed. [Boca Raton, Fla.: CRC Press, Inc., 1978]. Wit

26. Calculate the energy change (per mole) for this nuclear reaction:

${}^{235}_{92}U \rightarrow {}^{234}_{91}Pa + {}^{1}p$

$234.9934 = 233.9931 + 1.00728$

$\Delta m = 0.00698\text{ g} \times \frac{1\text{ kg}}{1000\text{ g}} = 6.98 \times 10^{-6}\text{ kg}$

$E = mc^2$ $\quad E = (6.98 \times 10^{-6})(3.00 \times 10^8)^2$

$= 6.28 \times 10^{11}$ J