

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?

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

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

$$\xrightarrow{\text{total}} 1.375 \text{ mol total}$$

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

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

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

$$P = 7.00 \text{ atm}$$

$$PV = nRT$$

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

$$V = 23.0 \text{ L}$$

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

$$n = 1.375 \text{ mol}$$

$$T = ? \text{ K}$$

$$\text{Ans: } \underline{1153 \text{ }^\circ\text{C}}$$

c. Which gas is moving faster?

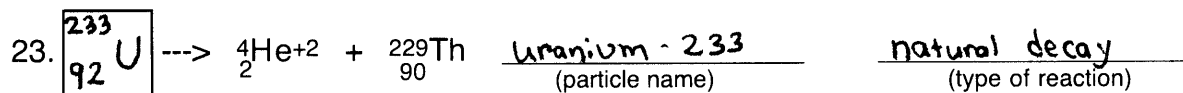
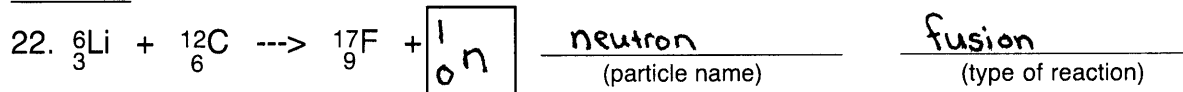
the lighter one...

He (use Graham's Law)

21. H₂ and O₂ are in the same flask. If the H₂ is moving at 755 mph, how fast is the O₂ moving?

$$\boxed{m_1 v_1^2 = m_2 v_2^2} \quad 2(755^2) = 32(v_2^2) \quad \boxed{v_2 = 189 \text{ mph}}$$

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

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

$$n = 3.27$$

$$\frac{140}{2^{3.27}} = 14.5$$

$$\boxed{15 \text{ g}}$$

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?

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

$$n = 1.66$$

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

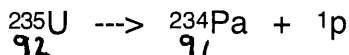
$$= 9510 \text{ yrs}$$

$$J = \text{kg} \cdot (\text{m/s})^2$$

$$\Delta E = \Delta mc^2$$

$$c = 3.00 \times 10^8 \text{ m/s}$$

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



$$234.9934 = 233.9931 + 1.00728$$

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

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

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

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 the table. For example, the mass of the ¹²C atom is 11.9967 + 6(0.000549) = 12.0000. (From R. C. Weast, ed., CRC Handbook of Chemistry and Physics, 59th ed. [Boca Raton, Fla.: CRC Press, Inc., 1978]. Wit