ANSWERS TO TOPIC C PROBLEMS

i. 503 mL
ii. –10ºC
iii. 4.97 g of O_2
iv. 3.70 L
v. 1.86 g/L.

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1) C_3H_6
2) 3.62 L
3) 137 torr
4) 0.016 M
5) 770 torr
6)

	C_2H_6	+	$7\ F_2$	→	$2\ CF_4$	+	$6\ HF$
Initial pressure:	127.3		329.5		89.1		0
Change:	-47.1		-329.5		+94.1		+282.43
Ending pressure:	80.2		0		183.2		282.43

7) 128.0 torr
8) 1589 torr
9) 33 torr

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10) a) 43.3 J b) 0.170 m/sec

11) a) 8.615×10^{-21} J b) 509.6 m/sec c) 188.3 J d) 416.0 K
e) 1729 J/mol f) 509.6 m/sec g) 469.5 m/sec h) 416.1 m/sec

12) a) 1.07×10^{-20} J b) 6440 J/mol c) 298.1 m/sec, so it is moving faster

13) a) 100ºC b) 560 K c) 560 K

14) a) The rms speed is directly related to the temperature and inversely related to the molar mass, but since the gases are at the same temperature, we need only consider the molar mass. **The N_2O has the higher rms speed**, because the molar mass of N_2O is lower than the molar mass of NO_2.
b) The two gases have **the same most probable kinetic energy**, because kinetic energy depends only on temperature, and both gases are at the same temperature.
c) Since the gases have the same temperature, pressure, and volume, they must contain the same number of moles, since n = PV/RT. However, a mole of NO_2 weighs more than a mole of N_2O, so **the NO_2 weighs more**.

15) a) **The NO_2 has the higher average kinetic energy**, because it is at a higher temperature.
b) For this question, we must do some arithmetic, because the two relevant factors (molar mass and temperature) are opposing each other; the NO_2 is hotter (which would give it a higher v_{mp}), but it also has a higher molar mass (which would give it a lower v_{mp}).

The most direct way to answer this question is to calculate the most probable speed for each gas. However, a simpler way is to recognize that whichever gas has the larger value of T/M has the higher v_{mp}. Since NO has the larger value of T/M, **NO has the higher most probable speed.**

c) We could use PV=nRT to calculate the moles of each gas, then convert to grams. The volume is not given, but it is the same for both gases, so we can just consider it a constant along with R. This means that the moles for each gas will be proportional to P/T.

$$n \propto \frac{P}{T}$$ (the squiggly sign means "proportional to...")

Converting to mass would be done by multiplying moles by the molar mass of each gas. So the mass of each sample can be ranked by considering

$$total\ sample\ mass\ \propto \frac{P}{T} \times molar\ mass$$

If you plug in the values for each gas, you'll find that **the sample of NO_2 must weigh**.

16) Review your textbook.

17) a) They have the same fraction of molecules with KE > 5000 J/mol.
a) b) The C_2H_6 has a larger fraction of molecules with speeds < 500 m/sec.

18) a) The Ar has the higher fraction of molecules with KE < 5 kJ/mol.
b) The Ar has the larger fraction of molecules with speeds > 500 m/sec.

19) a) around 700 J/mol. b) around 170 K. c) $y \approx 0.00023$.
d) 25.9% of the molecules have kintetic enegies between 2000 J/mol and 4000 J/mol.

20) a) Curve B b) Curve A

21) a) Curve A b) Curve C c) Curve B

22) a) 240 m/sec. b) Xe(g). c) $y \approx 0.0033$.
d) The fraction of molecules that have speeds above 400 m/sec is 0.111.
e) 0.889.

23) C_2H_4.

24) Review the textbook.

25) a) 884 moles b) 152 atm

26) Review the textbook.