

## Unit 4 Issue Analysis

### The Costs of Getting Around

Student Textbook pages 524-525

The topics addressed in this issue will likely be quite intuitively apprehensible to students, although they may never have looked so closely at all the particulars involved—never have “done the math.” You may want to have students use the following resources:

- Ask students to begin preparing for this debate well in advance by examining some arguments that dissociate economic growth from the consumption of fossil fuels. *Natural Capitalism: Creating the Next Industrial Revolution* by Paul Hawken, Amory Lovins and L. Hunter Lovins (Little, Brown & Co., 1999) is an excellent place to start.
- Another book that students may find useful, if challenging, in preparing for this debate is Richard Douthwaite’s *The Growth Illusion* (New Society, 1999).
- Katie Alvord’s *Divorce Your Car: Ending the Love Affair with the Automobile* (New Society, 2000) is a book that many students will find helpful. Alvord’s position is certainly clear, but the book will certainly be of interest to students who do not favour either reducing the use of automobiles, or introducing greater restrictions on emissions. This book would be excellent preparation to students on both sides of the debate.

While the three books mentioned above all tend to favour reducing the consumption of fossil fuels by automobiles, they are also valuable sources for references to the other side of the debate. While many students may want to take the side arguing for stricter protection of the environment, other students may be more interested in a sceptical economic analysis of increased vehicle emissions standards. These students may need extra help and encouragement in researching their position.

## Unit 4 Review Answers

Student Textbook pages 526–529

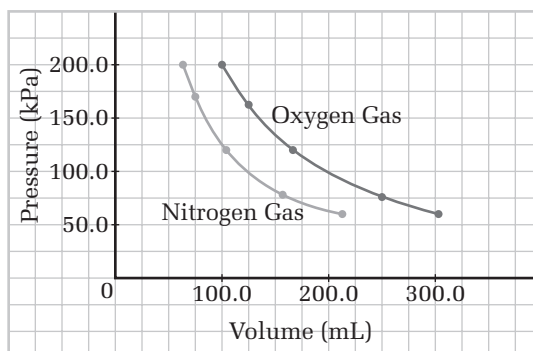
### Answers to Knowledge/Understanding Questions

1. (b)
2. (c)
3. (d)
4. (b)
5. (a)
6. (b)
7. (c)
8. (a)
9. (b)
10. (a)
11. (c)

## Answers to Inquiry Questions

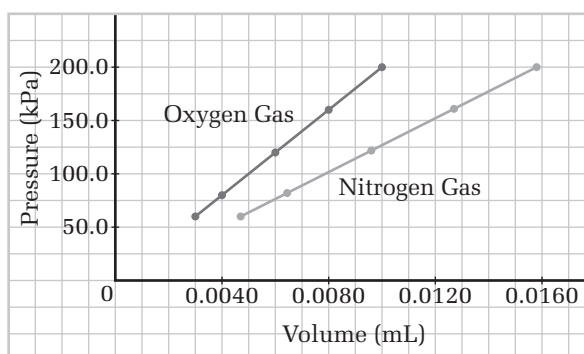
12. (a) The graphs will show an inverse relationship:

*P vs. V*



(b) The inverses are:

*P vs. 1/V*



Pressure (kPa)	Volume O <sub>2</sub>	1/Volume O <sub>2</sub>	Volume N <sub>2</sub>	1/Volume N <sub>2</sub>
60.0	333.0	$3.003 \times 10^{-3}$	212.8	$4.699 \times 10^{-3}$
80.0	250.0	$4.000 \times 10^{-3}$	156.2	$6.410 \times 10^{-3}$
120.0	166.5	$6.006 \times 10^{-3}$	104.0	$9.615 \times 10^{-3}$
160.0	125.0	$8.000 \times 10^{-3}$	78.8	$1.269 \times 10^{-2}$
200.0	100.0	$1.000 \times 10^{-2}$	63.4	$1.584 \times 10^{-2}$

(a) and (b) graphs

(d) As the pressure increases, the volume decreases, but by different amounts depending on the type of gas.

13. A real gas has particles with volume which do not have elastic collisions and do not travel in straight lines. Particles of ideal gases have no volume, no attractions, elastic collisions, and travel in straight lines.

14. (a) Boyle's law:  $PV = k$   
Avogadro's law:  $n = kV$

(b)  $n = \frac{PV}{RT}$

15. (a) The volume of the gas will also double.

(b) The volume will increase, but it will not double. That relationship only exists for Kelvin measurements.

(c) The volume will increase if the pressure is decreased because the gas molecules will be able to move further.

16. 0°C

17. 8.31 mol

18. 2.0 L  
19. 0.203 L  
20. 56.8 atm  
21. 368 kPa  
22. 374 dm<sup>3</sup>  
23. 49°C  
24.  $\frac{3}{2}V$   
25. (a) 4.6 L  
(b)  $3.8 \times 10^2$  kPa  
(d) 1030 L  
(e) 1.26 L  
(f) 88.4°C  
26. 56.1 mL  
27. methane: 750 kPa; oxygen: 480 kPa; nitrogen: 1100 kPa; propane: 2.4 kPa  
28. 250 L  
29. 78 kPa  
30. 22.5°C  
31. 16 kg  
32. oxygen: 7.5 L; carbon dioxide: 5.0 L  
33. 7.8 L  
34. 29.5 g  
35. 0.69 L  
36. C<sub>4</sub>H<sub>10</sub>O<sub>2</sub>  
37. C<sub>10</sub>O<sub>2</sub>H<sub>20</sub>  
38. (a)  $9.7 \times 10^{21}$   
(b)  $2.6 \times 10^{21}$   
(c)  $1.2 \times 10^{22}$   
(d)  $3.7 \times 10^{20}$   
39.  $3.23 \times 10^{-13}$

### Answers to Communication Questions

40. (a) The volume of a fixed mass of gas is directly proportional to its temperature (in K) if the pressure is constant.  
(b) Standard temperature, in STP is 0°C; in SATP is 25°C  
(c) Standard pressure, in STP is 101.3 kPa, in SATP is 100 kPa.  
(d) An ideal gas has particles that take up negligible amounts of space, do not attract each other, and move in straight lines.  
(e) Gay-Lussac's law: Temperature (K) of a gas is directly proportional to pressure.
41. (a) 523.1 K  
(b) 100°C  
(c) -273°C
42. (a) 96.6 kPa  
(b) 788.5 torr  
(c) 1.382 atm  
(d) 0.432 atm



**Student Textbook page 529**

Students have learned to identify a gas using volume and mass measurements. They have learned to collect a gas using water displacement. Oxygen and carbon dioxide are produced and used by plants.

43. The concept map should include the equations for the production of ozone and its breakdown.

### Answers to Making Connections Questions

44. The answers to these questions will depend on the size of the students' home town and the assumptions underlying their estimates on car usage.
45. Lithium hydride reacts with seawater to produce hydrogen, which can be used to inflate signal balloons.
46. Answers will depend on which year the students are doing the reasearch.