

CHAPTER 4 BLM ANSWER KEY

BLM 4-1: Pre-Chapter Quiz

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

BLM 4-4: Molecular Shape and Polarity

Formula	Lewis Structure	Type of Electron Pairs	VSEPR Notation	Name of Molecular Shape	Polarity of Molecule
CH ₄	<pre> H H — C — H H </pre>	4 BP	AX ₄	tetrahedral	non-polar
CH ₃ Cl	<pre> H H — C — Cl H </pre>	4 BP	AX ₄	tetrahedral	polar
CH ₂ Cl ₂	<pre> :Cl: H — C — H :Cl: </pre>	4 BP	AX ₄	tetrahedral	polar
CO ₂	<pre> :O=C=O: </pre>	2 BP	AX ₂	linear	non-polar
NH ₃	<pre> :N: H — N — H H </pre>	3 BP, 1 LP	AX ₃ E	trigonal pyramidal	polar
PI ₃	<pre> :I: :I — P — I: :I: </pre>	3 BP, 1 LP	AX ₃ E	trigonal pyramidal	polar
H ₂ S	<pre> :S: H — S — H </pre>	2 BP, 2 LP	AX ₂ E ₂	bent	polar
OF ₂	<pre> :F: :O: :F: : : F — O — F </pre>	2 BP, 2 LP	AX ₂ E ₂	bent	polar
PCl ₅	<pre> :Cl: :Cl: :Cl — P — Cl: :Cl: </pre>	5 BP	AX ₅	trigonal bipyramidal	non-polar

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Formula	Lewis Structure	Type of Electron Pairs	VSEPR Notation	Name of Molecular Shape	Polarity of Molecule
SF ₆		6 BP	AX ₆	octahedral	non-polar
ClF ₃		3 BP, 2 LP	AX ₃ E ₂	T-shape	polar

BLM 4-5: Quiz for Jigsaw—Properties of Liquids

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

BLM 4-6: Arrangement of Atoms in Metals and Ions in Crystals

- The maximum number of nearest neighbours is 12.
- The number of nearest neighbours is equal to the coordination number. The coordination number is 12.
- Model B is called face-centred cubic packing because the unit cell cube has a sphere in the centre of each face of the cube.
- The method of packing is face-centred cubic.
- The coordination number is 12 for each type of closest packing. There is no difference in density when spheres of the same size and weight are involved.
- The coordination number is 8 for this type of packing.
- Surrounding each Na⁺ ion are six Cl⁻ ions, and surrounding each Cl⁻ ion are six Na⁺ ions. The coordination number of each type of ions is 6.
- The ionic crystal should have a radius ratio of positive ion/negative ion that is about the same as the radius ratio of Na⁺/Cl⁻, which is 0.098 nm/ 0.181 nm = 0.541. The stability of this type of packing can be attributed to the proximity of ions of opposite charge.

Analysis

- Crystal XY would have a higher melting point because the attraction between the doubly charged ions is stronger. For example, CaO has a higher melting point (2850°C) than NaCl (801°C).
- The larger the ions, the farther apart are the charges. The attraction between oppositely charged ions is weaker. Crystal AB would have a lower melting point than NaCl. For example, KBr has a lower melting point (730°C) than NaCl (801°C).

BLM 4-7: Which Alternative Explanation Is More Acceptable?

- The author wants the reader to believe that glass does not flow.
- The old window panes are thicker at the bottom.
- One is that window panes were not of uniform thickness when they were made and that the window manufacturer placed the window panes with the thicker side at the bottom. The other is that glass slowly flowed under gravity to thicken at the bottom.
- The author believes that window panes were not of uniform thickness when they were made and that the window manufacturer placed the window panes with the thicker side at the bottom.
- The author does not give an explanation.
- The author's belief does not appear to be based on data. However, the rigid and very solid nature of glass certainly help to convince the author that the "builder" explanation is more probable.

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7. The author uses the word “misconception” to discount the “flowing glass” explanation.
8. Scientists usually use the more probable explanation to make a prediction, and then design an experiment to test the prediction. They may also debate with their colleagues before and after testing the prediction.
9. Any data that might shed light on the acceptance of one explanation over the other is acceptable. Some examples are:
 - knowledge about when the glass in question was made and when it was hung
 - historical trade records from the time the windows were hung that stated “wide side down” was the accepted procedure
 - papers of creditable scientists that discuss the properties of glasses and other amorphous solids
 - data that show the processes of making glass windows at the time the windows in question were hung
 - data about the thickness of window panes, i.e., whether window panes were always of the same thickness throughout
 - papers from the science of geology discussing the movement of other solid materials
10. Searching the internet might be the first choice, but using the library and searching abstracts are possible ways.
11. Debate is very much a part of developing scientific knowledge. There will always be alternative explanations for a given set of data because explanations are created by humans and their imagination. Previous experience is brought to bear on how people explain any information. That is why people more likely believe in an explanation of solid-flow from a scientist who has studied it than from another scientist who hasn't. In the CHEMFACT, the author is also in a debate with the student reader. The author chooses authoritative words to convince or win the argument. There is no alternatives presented to let the readers weigh the evidence and come to their own conclusion. Examples of scientific debate could be like the debate in the newspapers on the usefulness of flu shots or the debates that occur when papers are presented to colleagues at scientific meetings. Students may also relate to scientific debates that occurred a long time ago about flat earth, phlogiston, and polywater.
12. The answer will depend on the student. Some possibilities are:
 - Students have become more aware of how language is used.
 - Students have learned that they should challenge people and writers when claims are made and opinions stated without support.
 - Students have learned that the better way to arrive at an answer is to search all the alternative explanations and then gather opinions and data about each explanation.
 - Students have learned that their decision should be based on the weight of arguments for each explanation.
 - Students have learned that if glass flows at all, it could only be measured in terms of geological time scales, and thus would not be appropriate to explain window pane thickening.

BLM 4-8: Chapter 4 Test

Answers

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|-------|-------|-------|-------|-------|
| 1. a | 2. d | 3. d | 4. d | 5. a |
| 6. c | 7. b | 8. b | 9. c | 10. c |
| 11. a | 12. a | 13. c | 14. d | 15. a |
| 16. b | 17. c | 18. b | 19. d | 20. c |
21. non-polar: a, f, g, h; polar: b, c, d, e
22. The H — N — H bond angle in ammonia is less than the H — C — H bond angle in methane because the repulsion between a non-bonding pair and the bonding pairs in ammonia is greater than the repulsion between the bonding pairs in methane.
23. The measure of the O — C — O bond angle in carbon dioxide is 180°.
24. (a) trigonal pyramidal
(b) T-shaped
(c) octahedral
(d) linear
(e) trigonal pyramidal
(f) tetrahedral
(g) square planar