Name _____ Class _____ Date _____

Exercises

38.1 Models (page 767)

1. Models are assessed more in terms of their _____ than their _____.
2. Explain why scientists construct models.

_____

_____

3. Is the following sentence true or false? A model of the atom does not need to be consistent with a model for light because they are not related.

_____

4. Is the following sentence true or false? The emission of light is seldom related to the motion of electrons in atoms. _____
5. Circle the letter of each of the primary models of light.

a. particle model b. light model

c. matter model d. wave model

38.2 Light Quanta (page 768)

6. What is a quantum?

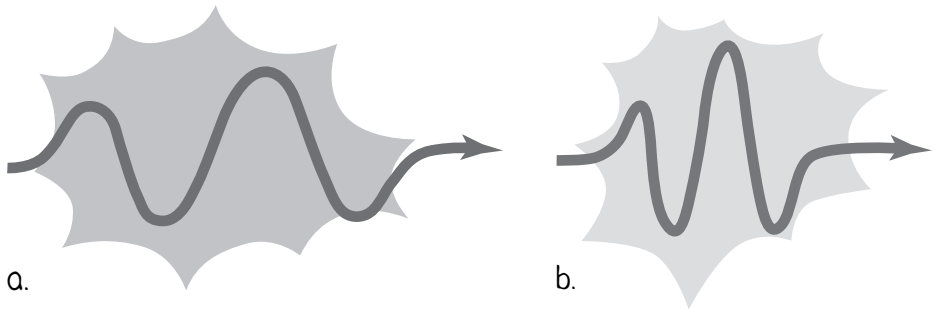
_____

_____

7. One quantum of light energy is also called a(n) _____.
8. Is the following sentence true or false? Many quantities are quantized, including mass, energy, and angular momentum. _____
9. The energy of a photon is directly proportional to its _____.
10. What is Planck's constant?

_____

_____



11. Which photon in the illustration above has greater energy and why?

_____

38.3 The Photoelectric Effect (pages 769–770)

12. What is the photoelectric effect?

_____

_____

13. Circle the letter(s) of the conditions that would cause the most number of electrons to be ejected from a photosensitive metal via the photoelectric effect.

a. dim, low-frequency light
b. bright, low-frequency light
c. dim, high-frequency light
d. bright, high-frequency light

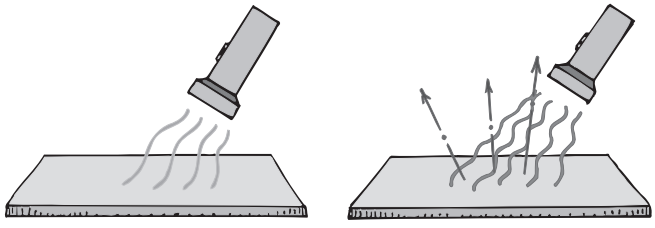
14. Is the following sentence true or false? The absorption of a photon by a metal atom is an all-or-nothing process. _____

15. When red light is shined onto the surface of a certain photosensitive metal, no electrons are ejected. Predict the effect of increasing the intensity, or brightness, of the light.

_____

_____

Use the illustration below to answer question 16. The illustration shows two tests for the photoelectric effect. The test shown on the left does not cause the photoelectric effect to occur. The test shown on the right does cause the photoelectric effect to occur. The same type of photosensitive metal is used in both tests.



16. Describe the difference between the light source on the left and the light source on the right.

_____

_____

17. Is the following sentence true or false? The photoelectric effect suggests that light interacts with matter as a wave. _____

38.4 Waves as Particles (page 770)

18. Describe how light behaves when it travels through the vacuum of space and when it encounters matter.

_____

_____

38.5 Particles as Waves (page 771)

19. According to de Broglie, all particles can be viewed as having _____ properties.

20. Is the following sentence true or false? The wavelengths of particles with large mass and ordinary speed can always be observed and measured. _____

21. All particles have a wavelength that is related to the momentum of the particles by $\text{wavelength} = \frac{h}{\text{momentum}}$, where h is _____.

22. The wavelength of a particle is called the _____ wavelength.

23. A beam of electrons can be diffracted. From this observation, you can deduce that a beam of electrons behaves like _____.

24. The electron microscope makes use of the _____ nature of electrons.

25. Explain why an electron microscope can distinguish much more detail than an optical microscope.

_____

_____

38.6 Electron Waves (pages 772–773)

26. The _____ model of the atom, which was developed by Niels Bohr, is helpful for explaining the atomic spectra of elements.

27. Describe the Bohr model in terms of energy levels of electrons.

_____

_____

28. When electrons move down from a high-energy orbit to a lower-energy orbit, _____ are emitted.

29. Describe how the lines in an atom's line emission spectrum are related to electron orbit transitions.

_____

_____

30. Is the following sentence true or false? Electron orbits only exist where an electron wave closes in on itself in phases. _____

31. Orbit circumferences are _____ multiples of the electron wavelengths.

32. Is the following sentence true or false? Each element has characteristic discrete energy levels. _____

33. Explain why an electron in a low-energy orbit does not spiral into the nucleus.

_____

_____

_____

38.7 Relative Sizes of Atoms (pages 774–775)

34. What is the determining factor of the radii of electron orbits in the Bohr model?

_____

35. Circle the letter that describes what happens to the size of inner electron orbits when the charge in the nucleus increases.

a. The inner electron orbits are unaffected. They do not change.

b. The inner electron orbits become larger.

c. The inner electron orbits collapse and fall into the nucleus.

d. The inner electron orbits become smaller.

36. Circle the letter that best describes the size of atoms of heavier elements compared to the size of atoms of lighter elements.

a. the same b. much larger

c. much smaller d. somewhat larger

37. Is the following sentence true or false? All elements have the same arrangement of electron orbits. _____

38.8 Quantum Physics (page 776)

38. _____ is the study of the motion of particles in the microworld of atoms and nuclei.

39. What is quantum physics?

_____

40. Is the following sentence true or false? When dealing with particles in the subatomic world, measurements become more uncertain.

_____

41. Are the subatomic interactions described by quantum mechanics governed by laws of probability or laws of certainty?

_____

38.9 Predictability and Chaos (pages 776–777)

42. Circle the letter(s) of examples of orderly systems.

a. the flight of a rocket

b. the motion of the planets

c. the decay of radioactive particles

d. the flow of water in a stream

43. What is a chaotic system?

_____

_____

44. Is the following sentence true or false? Weather is a chaotic system.

_____

45. What is the butterfly effect?

_____