

Assessment**Chapter 3****BLM 3-6****Chapter 3 Test****Goal**

Assess your understanding of the concepts you studied in Chapter 3.

Procedure

For each question, choose the best answer from the choices given.

- Which of the following support(s) the idea that electrons are arranged in distinct energy levels?
 - a continuous spectrum
 - electron affinities
 - spectra from electrical discharge through gases
 - first ionization energies

(a) I only (b) III only
(c) II and III only (d) III and IV only
- A student looks through a diffraction grating at the hydrogen discharge tube and notices purple, blue, green, and red lines. According to the energy level model of the atom, which activity of electrons accounts for these lines?
 - electrons that are continuously emitting energy
 - electrons that are dropping back to a lower energy level
 - electrons that are absorbing energy from the discharge passing down the tube
 - electrons that are jumping from the ground state to an excited state
- A student looks through a diffraction grating at an orange (luminous) Bunsen burner flame and is surprised to see a rainbow of colours. What is the name of this type of spectrum?
 - absorption spectrum (b) line spectrum
 - continuous spectrum (d) emission spectrum
- In the energy level model of the atom, how are the gaps between the energy levels arranged?
 - equally spaced
 - increasing as you move away from the nucleus
 - increasing with increasing atomic number
 - decreasing as you move away from the nucleus
- How many electrons does the ion ${}_{26}^{56}\text{Fe}^{3+}$ have?
 - 23 (b) 26 (c) 29 (d) 56

6. Which statement(s) about the energy of an atom is (are) correct?
- I. An atom is in its ground state when it has the least quantity of energy it may have.
 - II. An atom in the ground state may absorb only those quanta that enable its electrons to go to a higher energy level.
 - III. An atom can absorb any quantity of energy.
- (a) I and III only (b) I, II, and III
(c) I and II only (d) III only
7. Which quantity is measured directly using atomic line spectra?
- (a) the number of protons in the nucleus of an atom
 - (b) the absolute energy of an electronic energy level
 - (c) the number of electrons in an atom
 - (d) the energy difference between two energy levels
8. The light from all fluorescent lights, when analyzed in a spectrometer, exhibits the same lines in the yellow, green, and blue spectral regions. What can you conclude from this evidence?
- (a) Fluorescent lights contain fluorine gas.
 - (b) There are no gases present in fluorescent lights.
 - (c) The same element is present in all fluorescent lights.
 - (d) Air is present in all fluorescent lights.
9. Which scientist first postulated the nuclear atom?
- (a) Rutherford (b) Bohr
 - (c) Thomson (d) Dalton
10. Which observation indicated that Rutherford's nuclear model was not an adequate description of matter?
- (a) Atoms combine with other atoms in mole ratios that are simple whole numbers.
 - (b) When alpha particles bombard gold foil, about one in every 8000 bounce back.
 - (c) Fluorescent lights produce a rainbow of colours when viewed through a spectrometer.
 - (d) The emission spectra of hydrogen shows several coloured lines.
11. Which set of four numbers represents the maximum numbers of electrons in the first four energy levels of an atom?
- (a) 2, 8, 18, 32 (b) 1, 2, 8, 16 (c) 2, 8, 16, 24 (d) 1, 4, 9, 16

12. Which description of an orbital is the most accurate?
- (a) a cloud of hundreds of electrons
 - (b) a figure formed by the extremely rapid motion of electrons
 - (c) a solved wave function
 - (d) a cloud of electrons that is always perfectly circular
13. What is the maximum number of electrons that the energy level represented by $n = 4$ can have?
- (a) 8 (b) 12 (c) 18 (d) 32
14. What is the maximum number of electrons associated with any orbital?
- (a) 6 (b) 2 (c) 10 (d) 14
15. How many different values of the orbital-shape quantum number, l , are possible for the third energy level of an atom?
- (a) 1 (b) 3 (c) 5 (d) 7
16. Which statement best describes an occupied orbital, according to the quantum mechanical model?
- (a) It is a spherical or dumbbell-shaped route traced by the electron in its rapid movement.
 - (b) It is a region in space that has a precise shape and is completely filled by a dense electron cloud.
 - (c) It is a region in space in which the probability of finding an electron is high.
 - (d) It is an elliptical pathway that is followed by an electron outside the nucleus.
17. What does the magnetic quantum number, m_l , describe?
- (a) the orientation in space of the orbital
 - (b) the average distance of the electron from the nucleus
 - (c) the shape of the orbital
 - (d) the direction of spin of the electron
18. How many different values of the magnetic quantum number, m_l , are possible for the third energy level of an atom?
- (a) 1 (b) 3 (c) 5 (d) 7
19. Which type of orbital is represented by the quantum number $l = 3$?
- (a) s (b) p (c) d (d) f
20. What is the maximum number of electrons in the n th energy level of an atom?
- (a) n^2 (b) $2n^2$ (c) $n - 1$ (d) n

21. Which of the following electronic configurations is most characteristic of a non-metallic element?
- (a) $1s^2 2s^2 2p^6 3s^1$ (b) $1s^2 2s^2 2p^6 3p^1$
(c) $1s^2 2s^2 2p^6 3s^2$ (d) $1s^2 2s^2 2p^6 3s^2 3p^5$
22. Which ground state electron configuration represents the element with the highest first ionization energy?
- (a) $1s^2 2s^2 2p^3$ (b) $1s^2 2s^2 2p^5$
(c) $1s^2 2s^2 2p^6 3s^1$ (d) $1s^2 2s^2 2p^6 3s^2$
23. An element has the following ground state electron configuration: $1s^2 2s^2 2p^6 3s^2 3p^3$. Where is this element located in the periodic table?
- (a) Period 2, Group 1 (b) Period 3, Group 2
(c) Period 3, Group 13 (IIIA) (d) Period 3, Group 15 (VA)
24. Which ground state electron configuration most likely represents an alkali metal?
- (a) $1s^2 2s^2 2p^6 3s^2 3p^4$
(b) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$
(c) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10}$
(d) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^2$
25. Which ground state electron configuration represents an Mg^{2+} ion?
- (a) $1s^2 2s^2 2p^6 3s^2$ (b) $1s^2 2s^2 2p^6 3s^2 3p^2$
(c) $1s^2 2s^2 2p^6 3s^1$ (d) $1s^2 2s^2 2p^6$
26. Consider the following ground state electron configurations.
- I. $1s^2 2s^2 2p^6 3s^2$
II. $1s^2 2s^2 2p^6$
III. $1s^2 2s^2 2p^6 3s^1$
IV. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^1$
V. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6$
- Which electron configurations represent elements in the same group of the periodic table?
- (a) II and V (b) I and IV
(c) III and IV (d) I and III
27. Which species has the following ground state electron configuration: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^0 3d^8$?
- (a) Fe^+ (b) Ni (c) Ni^{2+} (d) Cu^{2+}

28. Which statement describes the trend of ionization energy in the periodic table?
- (a) increases across a period, from left to right
 - (b) decreases in a period, with increasing nuclear charge
 - (c) decreases across a period, from left to right
 - (d) increases with increasing atomic radii
29. Which ground state electron configuration represents the atom with the highest electron affinity?
- (a) $1s^2 2s^2 2p^6 3s^1$
 - (b) $1s^2 2s^2 2p^5$
 - (c) $1s^2 2s^2 2p^6 3s^2 3p^2$
 - (d) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6 4s^2$
30. Which set of elements has nearly the same atomic radius?
- (a) Be, B, C, N
 - (b) Ne, Ar, Kr, Xe
 - (c) C, P, Se, I
 - (d) Cr, Mn, Fe, Co