Quantum Mechanics answers

1.
    a. 8.21×10^{-19} J
    b. $\nu = 1.4 \times 10^{15}\ s^{-1}$, $E = 9.0 \times 10^{-19}$ J
2.
    a. $6.58 \times 10^{14}\ s^{-1}$
    b. 1.22×10^{8} nm
3. 1.2×10^{2} nm (UV)
4.
    a. 1.20×10^{18} photons
    b. 3.76×10^{8} W
5. 3.0×10^{19} photons
6. Yellow light will generate more electrons; blue light will generate electrons with greater kinetic energy.
7.
    a. Absorption
    b. Emission
    c. Emission
    d. Absorption
8. Yes, the predicted line spectra are accurate. The energies for a one-electron system would have the values $E_n = \frac{-(Z^2)2.18\times10^{-18}}{n^2}$ J where Z is the atomic number for the atom or ion. The energy levels fro Be^{3+} would be greater by a factor of 16 than those for the hydrogen atom. This means that the pattern of lines would be similar, but at different wavelengths.
9. 434.17 nm
10. 1875 nm
11. 2.76×10^{5} J/mol
12. d < a < c < b
13. 3.37×10^{-19} J/photon
14. Wavelengths associated with objects of ordinary size and mass are so extremely small that they are impossible to observe
15. 2.2×10^{-26} m/s
16.
    a. 1
    b. 5
    c. 3
    d. 9
17.

Q	Sublevel	Allowable m_l	No. orbitals
a	*D*	-2, -1, 0, 1, 2	5
b	*P*	-1, 0, 1	3
c	*f*	-3, -2, -1, 0, 1, 2, 3	7

18.
   a. No; n = 2, l = 0, m_l = 0; n = 2, l = 1,; m_l = -1
   b. Ok
   c. Ok
   d. No; n = 5, l = 2; m_l = +2; n = 5, l = 3; m_l = +3

19.
   a. $E = -\left[\frac{h^2}{(8\pi^2 m_e a_0^2)}\right]\left(\frac{1}{n^2}\right)$; constant = 2.180 x 10^{18} J, as in Bohr's theory
   b. 3.027 x 10^{-19} J
   c. 656.2 nm, yes

20.
   a. 2 → 1
   b. 5 → 2
   c. 4 → 2
   d. 3 → 2
   e. 6 → 3

21.
   a. n = 1, l =1, m_l = 1
   b. n = 3, l = 2, m_l = +1
   c. n = 7, l = 3, m_l = +3
   d. n = 4, l = 2, m_l = -2

22. m_s relates just to the electron, the others describe the orbital.
23. Shielding occurs when inner-shell electrons protect or shield outer-shell electrons from the full attractive force of the nucleus. The effective nuclear charge is the nuclear charge an electron actually experiences. As the number of shielding electrons increases, the effective nuclear charge decreases.
24.
   a. 6
   b. 2
   c. 14

25.
   a. n = 5, l = 0, m_l = 0, m_s = ½
   b. n = 3, l = 1, m_l = 1, m_s = ½
   c. n = 5, l = 0, m_l = 0, m_s = ½
   d. n = 2, l = 1, m_l = 1, m_s = ½

26.
   a. O; group 6 period 2
   b. P, group 5, period 3

27. Atomic radius increases from top to bottom in a group, whereas ionization energy decreases from top to bottom in a group. The farther away an electron is from the nucleus, the more easily it is removed.