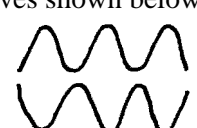





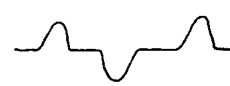
## 7 • Atomic Structure

### PRACTICE TEST

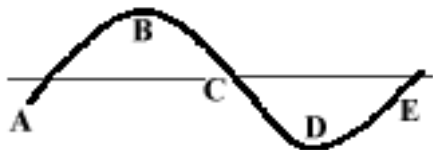
$c = \lambda\nu$	$E = h\nu$	$E = \frac{hc}{\lambda}$	$E_n = -\frac{Rhc}{n^2}$	$\lambda = \frac{h}{mv}$	$\frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{n^2}\right)$
$c = 2.998 \times 10^8 \text{ m/s}$	$h = 6.626 \times 10^{-34} \text{ J}\cdot\text{s}$	$Rhc = 2.18 \times 10^{-18} \text{ J}$	$R = 1.0974 \times 10^7 \text{ m}^{-1}$	mass of an electron = $9.11 \times 10^{-31} \text{ kg}$	

- What wavelength corresponds to a frequency of  $8.22 \times 10^9 \text{ Hz}$ ?
  - 0.307 m
  - 0.0365 m
  - 0.122 m
  - 0.110 m
  - 27.4 m
- A radio station transmits at 110 MHz ( $110 \times 10^6 \text{ Hz}$ ). What wavelength is this radio wave?
  - $3.65 \times 10^{-5} \text{ m}$
  - 3.30 m
  - $3.81 \times 10^{-5} \text{ m}$
  - 2.73 m
- Which one of the following is NOT a proper unit for frequency?
  - Hz
  - $\text{s}^{-1}$
  - $\text{m}\cdot\text{s}^{-1}$
  - $\frac{1}{\text{sec}}$
- Calculate the wavelength of the fourth line in the Balmer series (the visible series) of the hydrogen spectrum.
  - 0.12334 m
  - 24.373 m
  - $2.7353 \times 10^{-7} \text{ m}$
  - $4.1029 \times 10^{-7} \text{ m}$
  - 36.559 m
- What is the relationship between the energy of a photon of light and its frequency?
  - $E = \nu$
  - $E = \frac{h}{\nu}$
  - $E = h\nu$
  - $E = \frac{1}{h\nu}$
  - $E = \frac{\nu}{h}$
- What is the energy needed to raise an electron in the hydrogen atom from the second energy level to the third energy level?
  - $1.52 \times 10^4 \text{ J}$
  - $3.63 \times 10^{-19} \text{ J}$
  - $2.18 \times 10^{-19} \text{ J}$
  - $4.48 \times 10^{-19} \text{ J}$
  - $3.03 \times 10^{-19} \text{ J}$
- What is the de Broglie wavelength of an electron moving at 80.0% the speed of light.
  - $3.03 \times 10^{-12} \text{ m}$
  - $2.42 \times 10^{-12} \text{ m}$
  - $3.30 \times 10^{11} \text{ m}$
  - $1.59 \times 10^{-25} \text{ m}$
- What resultant is expected from the interference of the two waves shown below?
 



  - 
  - 
  - 
  - 
- Which quantum number determines the type of **subshell** occupied by an electron (s, p, d, f, etc.)?
  - $n$
  - $l$
  - $m_l$
  - $g$

10. What position on the traveling wave shown below corresponds to a crest?



- a) A    b) B    c) C    d) D    e) E

11. How many orbitals make up the **4d** subshell?

- a) 0    b) 1    c) 3    d) 5    e) 7

12. The value of  $\ell$  that is related to the following orbital is:

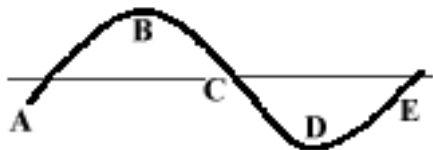


- a) 0    b) 1    c) 2    d) 3    e) 4

13. Which of the following sets of quantum numbers is possible for a **3d** electron?

- a)  $n = 3, \ell = 3, m_\ell = -2, m_s = +\frac{1}{2}$   
 b)  $n = 2, \ell = 1, m_\ell = +1, m_s = -\frac{1}{2}$   
 c)  $n = 3, \ell = 1, m_\ell = 0, m_s = -\frac{1}{2}$   
 d)  $n = 3, \ell = 2, m_\ell = -2, m_s = +\frac{1}{2}$   
 e)  $n = 4, \ell = 1, m_\ell = +1, m_s = +\frac{1}{2}$

14. If this were a standing wave, there are \_\_\_\_ node(s) shown.



- a) 1    b) 2    c) 3    d) 4    e) 5

15. When  $\ell = 2$ , the possible values of  $m_\ell$  are

- a) 0, 1  
 b) 0, 1, 2  
 c) +1, 0, -1  
 d) +2, +1, 0, -1, -2  
 e) +2, 0, -2

16. The red line in the hydrogen spectrum is the result of an electron moving from?

- a)  $n=2 \rightarrow n=5$     d)  $n=4 \rightarrow n=2$   
 b)  $n=3 \rightarrow n=2$     e)  $n=2 \rightarrow n=3$   
 c)  $n=2 \rightarrow n=1$

17. Who explained that light has both particle and wave character?

- a) Thomson    d) Bohr  
 b) Rutherford    e) de Broglie  
 c) Einstein

18. Which energy level of the hydrogen atom is not involved in the Balmer Series of visible lines?

- a) 1    b) 2    c) 3    d) 4    e) 5

19. Which of the following best supports the concept that electrons in atoms have quantized energies?

- a) The photoelectric effect  
 b) The alpha particle scattering experiment  
 c) The emission spectrum of hydrogen  
 d) The wave-particle duality of an electron  
 e) The charge/mass ratio of an electron

20. Draw an "s" orbital and a "p" orbital.