This print-out should have 6 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

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**ChemPrin3e 01 02**

**001** 10.0 points

What is the correct order of decreasing frequency?

**1.** infrared radiation, radio waves, visible light, ultraviolet radiation

**2.** radio waves, infrared radiation, visible light, ultraviolet radiation

**3.** visible light, ultraviolet radiation, infrared radiation, radio waves

**4.** radio waves, visible light, ultraviolet radiation, infrared radiation

**5.** ultraviolet radiatioin, visible light, infrared radiation, radio waves **correct**

**Explanation:**
ultraviolet radiation > visible light
> infrared radiation > radio waves

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**Particle Properties**

**002** 10.0 points

Which phenomenon provides the best evidence that light can have particle properties?

**1.** Electron diffraction

**2.** Electromagnetic radiation

**3.** X-ray diffraction

**4.** Interference of light in thin films

**5.** Photoelectric effect **correct**

**Explanation:**
Interference of light in thin films and electromagnetic radiation are generally used to show the wavelike properties of light. Electron diffraction is used to show the wavelike properties of matter. X-ray diffraction is a result of the wave properties of light.

The photoelectric effect supports the idea that light is quantized, or carries discrete amounts of energy. This is a property of particles manifested by light.

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**ChemPrin3e T01 09**

**003** 10.0 points

Calculate the wavelength of a motorcycle of mass 275 kg traveling at a speed of 125 km/hr.

**1.** $2.08 \times 10^{-29}$ m

**2.** $2.41 \times 10^{-36}$ m

**3.** $1.93 \times 10^{-38}$ m

**4.** $6.94 \times 10^{-38}$ m **correct**

**5.** $1.93 \times 10^{-41}$ m

**Explanation:**
$v = 125$ km/h $= 125000$ m/h  $m = 275$ kg

$$\lambda = \frac{h}{m\,v}$$
$$= \frac{6.626 \times 10^{-34}\ \text{J} \cdot \text{s}}{(275\ \text{kg})\left(\frac{125000\ \text{m}}{3600\ \text{s}}\right)}$$
$$= 6.93923 \times 10^{-38}\ \text{m}$$

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**OneD Ground State**

**004** 10.0 points

If a particle is in a one-dimensional box and is in its ground state, where would you MOST probably find the particle?

**1.** at the two ends of the box

**2.** in the center of the box **correct**

**3.** anywhere in the box

**4.** either side of the center of the box

**Explanation:**

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**Msci 05 1403**

**005** 10.0 points

In a given atom, what is the maximum number of electrons that can have principal quantum number $n = 3$?

**1.** 8

**2.** 18 **correct**

**3.** 32

**4.** 10

**5.** 2

**Explanation:**

There are 2 electrons in the $3s$ orbital, 6 electrons in the $3p$ orbitals, and 10 electrons in the $3d$ orbitals to give a total of 18 electrons.

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**Msci 05 1416**

**006** 10.0 points

Can an electron in an atom be in an energy level described by the set of quantum numbers $n = 5$, $\ell = 3$, $m_\ell = -2$?

**1.** No, because $\ell$ must be equal to $n - 1$.

**2.** No, because $n$ cannot be as large as 5.

**3.** No, because $m_\ell$ must be equal to $\pm 1$.

**4.** No, because $m_\ell$ cannot be negative.

**5.** Yes **correct**

**Explanation:**

Since $n$ is 5, the possible values of $\ell$ are 0, 1, 2, 3, and 4. Since 3 is a possible value, we then consider if $m_\ell$ could be $-2$ when $\ell$ is 3. The possible values of $m_\ell$ are $+3$, $+2$, $+1$, 0, $-1$, $-2$, and $-3$ when $\ell$ is 3, so this combination of quantum numbers is permitted.