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| 28  Marks Total | ASSIGNMENT 14  **Compton, de Broglie, and Wave-Particle Duality**  This assignment is worth 28 marks. The value of each question is noted in parentheses in the left margin. Note: The answer areas will expand to fit the length of your response. |

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| **1.**  (1) | There are similarities and differences between the Photoelectric Effect and Compton Scattering. Complete each of the six partial statements below using the following guide; all you need to provide for an answer is PE, CS, BOTH, or NEITHER.   * PE if the statement only applies to the Photoelectric Effect * CS if the statement only applies to Compton Scattering * BOTH if the statement only applies to both the Photoelectric Effect and Compton Scattering * **NEITHER** if the statement applies to Neither the Photoelectric Effect or Compton Scattering  1. Energy is conserved in \_\_\_\_\_. |
| Answer: |  |
| (1) | 1. Photons are observed before and after the interaction in \_\_\_\_\_. |
| Answer: |  |
| (1) | 1. Electrons are observed as the result of the experiment in \_\_\_\_\_. |
| Answer: |  |
| (1) | 1. Angles are measured in the experiment in \_\_\_\_\_. |
| Answer: |  |
| (1) | 1. Photons with very low energies such as 5.0 to 10.0 eV is observed in \_\_\_\_\_. |
| Answer: |  |
| (1) | 1. Ionization occurs in \_\_\_\_\_. |
| Answer: |  |
| (2) **2.** | What quantity measured in the Compton effect experiment show the wave-particle duality of light? |
| Answer: |  |
| (5) **3.** | An X-ray with a frequency of 3.74 × 1020 Hz is incident on a thin piece of metal. The lower frequency X-ray on the other side is observed deflected at 48o. What is the frequency of the deflected X-ray? |
| Answer: |  |
| (5) **4.** | A scientist changes the frequency of an incident X-ray to 4.50 × 1019 Hz and measures the deflected X-ray frequency of 4.32 × 1019 Hz. What was the angle of deflection? |
| Answer: |  |
| (2) **5.** | Can the equation *E = pc* be applied to particles? Why or why not? |
| Answer: |  |
|  |  |
| (3) **6.** | A stationary hydrogen atom with a mass of 1.67 × 10-27 kg absorbs a photon of light with 10.2 eV. What is the velocity of the hydrogen atom after absorbing the photon in a perfectly inelastic collision? |
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| Answer: |  |
| 1. **7.** | Describe the results of performing Young’s experiment with x-rays and then high speed electrons. |
| Answer: |  |
| (2) **8.** | How do the results of performing Young’s experiment with x-rays and then high speed electrons support the wave-particle model? |
| Answer: |  |
| (1) **9.** | All of the following quantities can be measured or calculated for light waves and subatomic particles except \_\_\_\_\_.   1. momentum 2. velocity 3. frequency 4. energy |
| Answer: |  |

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| When you have completed all of the questions in this assignment, submit your work. |