

Homework #10 (749508)

Current Score: 0 out of 100

Description

Homework on quantum physics and radioactivity

Instructions

Answer all the questions as best you can.

1. Hewitt10 32.E.001. [481697] 0/5 points

Consider photons emitted from an ultraviolet lamp a TV transmitter.

(a) Which is the greater wavelength?

- ultraviolet lamp
 TV transmitter

(b) Which is the greater energy?

- ultraviolet lamp
 TV transmitter

(c) Which is the greater frequency?

- ultraviolet lamp
 TV transmitter

(d) Which is the greater momentum?

- ultraviolet lamp
 TV transmitter

2. Hewitt10 32.E.002. [481702] 0/5 points

Which color light comes from a greater energy transition, red or blue?

- blue
 red

3. Hewitt10 32.P.001. [481739] 0/5 points

The higher the energy level occupied by an electron in the hydrogen atom, the larger the atom. The diameter of the atom is proportional to n^2 , where $n = 1$ labels the lowest, or "ground" state, $n = 2$ is the second state, $n = 3$ is the third state, and so on. If the atom's diameter is 1×10^{-10} m in its lowest energy state, what is its diameter in state number 45?

m

How many unexcited atoms could be fit within this one giant atom?

4. Hewitt10 31.E.013. [481607] 0/5 points

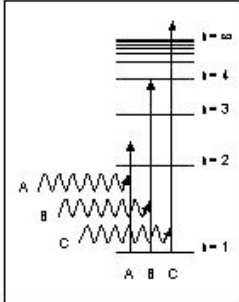
In the photoelectric effect, does brightness or frequency determine the kinetic energy of the ejected electrons?

- frequency
 brightness

Does brightness or frequency determine the number of the ejected electrons?

- brightness
 frequency

5. photons [421206] 0/5 points



The diagram above shows the levels $n=1$ to ∞ for a hydrogen atom as described by Bohr. The arrows are energy changes in the hydrogen electron resulting from photons of light (A, B, and C) at various frequencies interacting with the hydrogen atom at different times. Based on the diagram, which of the following photons will be absorbed (check all that apply):

- Photon A
 Photon B
 Photon C
 None of these are absorbed

6. Hewitt10 33.E.002. [481751] 0/5 points

X rays are most similar to which of the following: alpha, beta, or gamma rays?

- beta
 gamma
 alpha

7. Hewitt10 33.E.009. [481531] 0/5 points

Which type of radiation--alpha, beta, or gamma--results in the greatest change in mass number?

- gamma
 alpha
 beta

Which type of radiation results in the greatest change in atomic number?

- beta
 alpha
 gamma


8. Hewitt10 33.E.010. [812330] 0/5 points

Which type of radiation--alpha, beta, or gamma--results in the least change in mass number? Select all that apply.

- gamma
 alpha


 beta

Which type of radiation results in the least change in atomic number?


-  gamma
 alpha
 beta

9. Hewitt10 33.E.017. [481594] 0/5 points

Which interaction tends to hold an atomic nucleus together?

-  nuclear force
 electric force
 gravitational force

Which interaction tends to push a nucleus apart?

- nuclear force
  electric force
 gravitational force

10. Hewitt10 33.E.023. [481752] 0/5 points

Radiation from a point source obeys the inverse-square law. If a Geiger counter 1 m from a small sample reads 792 counts per minute, what will be its counting rate 2 m from the source?

counts/min

What will be its counting rate at 3 m?

88

counts/min

11. Hewitt10 33.E.027. [481415] 0/5 points

If an atom has 104 electrons, 157 neutrons, and 104 protons, what is its approximate atomic mass?

What is the name of this element?

12. Hewitt10 33.E.028. [481470] 0/5 points

When $^{226}_{88}\text{Ra}$ decays by emitting an alpha particle, what is the atomic number of the resulting nucleus?

What is the resulting atomic mass?

13. Hewitt10 33.E.029. [481529] 0/5 points

When $^{218}_{84}\text{Po}$ emits a beta particle, it transforms into a new element. What are the atomic number and atomic mass of this new element?

atomic number

atomic mass

What are they if the polonium instead emits an alpha particle?

atomic number

atomic mass

14. Hewitt10 33.E.048. [481748] 0/5 points

(a) Is carbon dating advisable for measuring the age of materials a few years old?

- Yes
 No

(b) Is carbon dating advisable for measuring the age of materials a few thousand years old?

- Yes
 No

(c) Is carbon dating advisable for measuring the age of materials a few million years old?

- Yes
 No

15. Hewitt10 33.P.001. [481747] 0/5 points

If a sample of a radioactive isotope has a half-life of 2 year(s), how much of the original sample will be left at the end of the second year?

of the original sample

How much will be left at the end of the third year?

of the original sample

How much will be left at the end of the fourth year?

of the original sample

16. Hewitt10 33.P.002. [481672] 0/5 points

A sample of a particular radioisotope is placed near a Geiger counter, which is observed to register 160 counts per minute. **Four** hours later the detector counts at a rate of 10 counts per minute. What is the half life of the material?

hours

17. Hewitt10 33.P.003. [481534] 0/5 points

The isotope cesium-137, which has a half-life of 30 years, is a product of nuclear power plants. How long will it take for this isotope to decay to about **one thirty-second** its original amount?

years

18. Laser frequency and power [584948] 0/5 points

A laser outputs pure red light of photon energy 1.8 eV with power 25 mW. Remember that Planck's constant $h = 4.14 \times 10^{-15} \text{ eV s}$

a) What is the frequency of the light in Hz? (your answer should be in scientific notation, example 2.0e+12)

4.35e+14

Hz

b) How many photons per second does this laser emit? (again your answer should be in scientific notation, example 2.0e+12)

8.68e+16

photons/s

Solution or Explanation

(a) Use $E=hf$ to determine the frequency.

(b) If there are N photons of energy E emitted in one second, the output power is NE J/s. Solve for N , remembering to express the photon energy in joules, where $1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$.

19. Uncertainty Principle [824575] 0/5 points

The speed of an electron is measured to within an uncertainty of $\pm 3.2 \times 10^4$ m/s. What is the size of the smallest region of space in which the electron can be confined?

3.6 nm

20. radiocarbon dating corrected [1041349] 0/5 points

An archaeological expedition found pieces of wood that contained 40 g of ^{12}C and was found to have an activity of 150 counts/min. How old is the wood? Use 5730 years for the half life of ^{14}C .

10600 years.

Assignment Details