AP Physics 2: Algebra Based: Unit - 7 - Quantum, Atomic and Nuclear Physics Practice Test

Question 1

Rex the dog died in 1750. What percentage of his original carbon-14 remained in 1975 when he was found by scientists? The half-life of carbon-14 is 5730 years.

A. 77%
B. 27.4%
C. 10.7%
D. 97.3%

Question 2

What do waves carry from place to place?

A. Matter or particles but not energy
B. Energy and matter or particles
C. Energy but not matter or particles
D. Neither energy nor matter or particles

Question 3

The photoelectric effect only occurs if the light shining on the metal is:

A. Coherent
B. Above a minimum intensity
C. Above a minimum frequency
D. Above a minimum wavelength

Question 4

How much energy is contained in a particle that has a mass of m=1μg?

A. $E=9x10^{7}J$
B. $E=9x10^{33}J$
C. $E=9x10^{10}J$
D. $E=9J$

Question 5

What must the minimum energy of photons falling on a copper plate be in order to observe the photoelectric effect? (Work function for copper 4.7 eV)

A. 2.35 eV
B. 4.7 eV
C. 1.175 eV
D. 9.4 eV

Question 6

Which types of waves can travel through a vacuum?

A. Mechanical
B. Sound
C. Seismic
D. Light

Question 7

Suppose that the mass of a neutral Uranium atom is measured and found to be 235.0349amu. However, after adding up the mass of all constituent protons, neutrons, and electrons, the predicted mass of a Uranium atom is expected to be equal to 236.9601amu. Based on this information, what is the nuclear bindin $1amu = 1.66 * 10^{-27} kg$ atom?

$$1J = 6.24 * 10^{12} MeV$$

A. 1924 MeV
B. 1794 MeV
C. 1832 MeV
D. 1637 MeV

Question 8

You measure the beta decay activity of an unknown substance to be 5306Bq. 48 hours later, the activity is 510Bq. What is the half-life in hours?

A. 14.2 hours
B. 16.3 hours
C. 24 hours
D. 48 hours

Question 9

What is the wavelength of an electron moving at 5.31 x 10^{6} m/sec?
Given: mass of electron = 9.11 x 10^{-31} kg; h = 6.626 x 10^{-34} J·s

A. $1.37\,x\,10^{-10} m \vee 1.37\,Å$
B. $6.23\,x\,10^{-10} m \vee 6.23\,Å$
C. $2.15\,x\,10^{-10} m \vee 2.15\,Å$
D. $3.74\,x\,10^{-10} m \vee 3.74\,Å$

Question 10

What is the wavelength of light that has a frequency of 1.20 x 10^{13} s^{-1}?

A. 2.5 m
B. 25.0 m
C. 0.025 m
D. $2.5\,x\,10^{-5} m$

Question 11

Particles whose motions are better described by quantum mechanics can only gain or lose energy in discrete units called

A. Atoms
B. Quanta
C. Protons
D. Electrons

Question 12

The de Broglie wavelength of an electron is 1.21 x 10^{-2} nm. It is traveling at what percent of the speed of light?

A. 10%
B. 20%
C. 30%
D. 40%

Question 13

A physicist is trying to determine the identity of a metal by experimentally finding its work function and then comparing the experimental value to a list of known values. If the physicist shines light with a frequency of 3.76 $x10^{14}$ Hz on the metal and records an electron speed of 8.6 work function of the metal? Use:

$m_{\text{electron}} = 9.1 \cdot 10^{-31} kg$

$h = 6.63 \cdot 10^{-34} J \cdot s$

$1\,eV = 1.6 \cdot 10^{-19} J$

A. 3.66 eV
B. 5.93 eV
C. 2.36 eV
D. 4.89 eV

Question 14

What total mass must be converted into energy to produce a gamma photon with an energy of 1.03 × 10-13 joule?

A. $1.8\,x10^{12}\,kg$
B. $2.34\,x10^{15}\,kg$
C. $1.14\,x10^{-30}\,kg$
D. $3.27\,x10^{-20}\,kg$

Question 15

Two grams of helium are completely converted into energy and used to power a 100kg man. If all of this energy is converted into kinetic energy of the man, how fast will he move?

A. $v \approx 245.1 \frac{m}{s}$

B. $v \approx 6\,x10^{5} \frac{m}{s}$

C. $v \approx 109.5 \frac{m}{s}$

D. $v \approx 1.9 x 10^6 \frac{m}{s}$

Question 16

A spontaneous process that occurs when an atom emits radiation and/or a particle from its nucleus to become more stable is _____.

A. Half-life
B. Radioactive Decay
C. Nuclear Reaction
D. Photoelectric effect

Question 17

How many orbitals (including sub orbitals) are found in a shell with $n = 2$?

A. 1
B. 2
C. 3
D. 4

Question 18

Which statement about the photoelectric effect is correct?

A. Electrons are emitted instantaneously
B. You can change the energy of the electrons by changing the intensity
C. Electrons are not emitted below a certain wavelength
D. Electron energy is independent of frequency.

Question 19

A scientist tests a radioactive sample which has an activity of 1868 Bq. 15 minutes later, it has an activity of 768 Bq. Determine the number of radioactive nuclei in the initial sample.

A. $N = 3.58 x 10^6$
B. $N = 3.13 x 10^6$
C. $N = 1.90 x 10^6$
D. $N = 2.15 x 10^6$

Answer Key

1. A
2. B
3. D
4. C
5. A
6. B
7. C
8. B
9. D
10. A
11. A
12. D
13. A
14. B
15. C
16. B
17. A
18. D
19. B