Name: _____ Class: _____ Date: _____ ID: A

AP Physics 2 - Chapters 27-29 Practice

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. In an experiment different wavelengths of light, all able to eject photoelectrons, shine on a freshly prepared (oxide-free) zinc surface. Which statement is true?
a. The number of photoelectrons emitted per second is independent of the intensity of the light for all the different wavelengths.
b. The number of photoelectrons emitted per second is directly proportional to the frequency for all the different wavelengths.
c. The maximum kinetic energy of the photoelectrons emitted is directly proportional to the frequency for each wavelength present.
d. The maximum kinetic energy of the photoelectrons has a linear relationship with the frequency for each wavelength present.

____ 2. When a photon collides with a free electron at rest and the direction of motion of the photon changes,
a. the magnitude of the momentum of the photon does not change.
b. the momentum of the electron does not change.
c. the kinetic energy of the electron does not change.
d. both the magnitude of the momentum and the total energy of the photon decrease.

____ 3. Photoelectrons are ejected when monochromatic light shines on a freshly-prepared (oxide-free) sodium surface. In order to obtain the maximum increase in the number of electrons ejected per second, the experimenter needs to
a. increase the frequency of the light.
b. increase the intensity of the light.
c. increase the area illuminated by the light.
d. do all of the above.
e. do only (b) and (c) above.

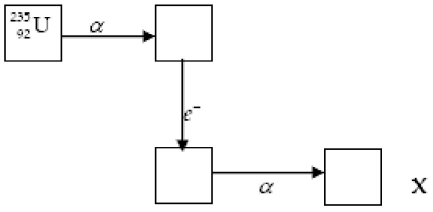
____ 4. What value of Z (atomic number) and A (mass number) result in the following alpha decay? ${}^{238}_{92}\mathrm{U} \rightarrow {}^{A}_{Z}\mathrm{X} + \alpha$
a. $Z = 92$; $A = 238$ b. $Z = 91$; $A = 238$ c. $Z = 90$; $A = 234$ d. $Z = 93$; $A = 238$

____ 5. What value of Z (atomic number) and A (mass number) result in the following β-decay? ${}^{14}_{6}\mathrm{C} \rightarrow {}^{A}_{Z}\mathrm{X} + e^{-}$
a. $Z = 5$; $A = 14$ b. $Z = 4$; $A = 10$ c. $Z = 6$; $A = 14$ d. $Z = 7$; $A = 14$

____ 6. What value of Z (atomic number) and A (mass number) result in the following β-decay? ${}^{12}_{7}\mathrm{N} \rightarrow {}^{A}_{Z}\mathrm{X} + e^{+}$
a. $Z = 6$; $A = 12$ b. $Z = 5$; $A = 8$ c. $Z = 6$; $A = 11$ d. $Z = 8$; $A = 12$

____ 7. What value of Z (atomic number) and A (mass number) result in the following gamma decay? ${}^{12}_{6}\mathrm{C} \rightarrow {}^{A}_{Z}\mathrm{X} + \gamma$
a. $Z = 6$; $A = 11$ b. $Z = 4$; $A = 8$ c. $Z = 7$; $A = 12$ d. $Z = 6$; $A = 12$

____ 8. The chart shows part of the radioactive series beginning with the isotope ${}^{235}_{92}\mathrm{U}$. The isotope marked with an X is



a. ${}^{226}_{88}\mathrm{Ra}$. b. ${}^{227}_{88}\mathrm{Ra}$. c. ${}^{227}_{89}\mathrm{Ac}$. d. ${}^{231}_{90}\mathrm{Th}$. e. ${}^{231}_{91}\mathrm{Pa}$.

____ 9. Naturally radioactive nuclei can decay spontaneously by emitting the following particles:
a. helium nuclei, electrons, photons
b. electrons, neutrons, protons
c. helium nuclei, electrons, protons
d. electrons, neutrons, photons

Short Answer

10. The threshold wavelength for photoelectric emission of a particular substance is 500 nm. What is the work function (in eV)?

11. What is the maximum velocity (in m/s) of a photoelectron emitted from a surface whose work function is 5.0 eV when illuminated by a light whose wavelength is 200 nm?

12. A stopping potential of 3.2 V is needed for radiation whose wavelength is 200 nm. What is the work function (in eV) of the material?

13. A solid state pulsed laser has an energy of 400 mJ per pulse. If its wavelength is 1.06×10^{-6} m, how many photons are in each pulse?

14. A neutron has a mass of 1.67×10^{-27} kg. The de Broglie wavelength is 1.4×10^{-10} m. How fast is it going?

15. An energy of 13.6 eV is needed to ionize an electron from the ground state of a hydrogen atom. Selecting the longest wavelength that will work from the those given below, what wavelength is needed if a photon accomplishes this task?

16. An electron is moving at a speed of 2.1×10^{6} m/s in the first Bohr orbit. Determine its de Broglie wavelength.

17. An alpha particle is emitted from a radioactive source with an energy of 5 MeV. How fast is it moving? (m = 4.002 603 u, 1 u = 1.66×10^{-27} kg)

18. The isotope, tritium, has a half-life of 12.3 years. Assume we have 10 kg of the substance. How much tritium will be left after 30 years?

19. A glass container holds equal numbers of atoms of phosphorus 30 with a half-life of 2.5 minutes and of nitrogen 13 with a half-life of 10 minutes. After 20 minutes the ratio of the number of nitrogen atoms remaining to the number of phosphorus atoms remaining is

20. The radiocarbon content of ^{14}C decreases after the death of a living system with a half-life of 5730 y. If an archaeologist working a dig finds an ancient firepit containing some partially consumed firewood and the wood contains only 12.5 percent of the ^{14}C content of an equal carbon sample from a present-day tree, what is the age of the ancient site?

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Answer Section

MULTIPLE CHOICE

1. D
2. D
3. E
4. C
5. D
6. A
7. D
8. C
9. A

SHORT ANSWER

10. 2.5 eV
11. 650,000 m/s
12. 3.0 eV
13. 2×10^{18} photons
14. 2800 m/s
15. 90 nm
16. 3.5×10^{-10} m
17. 1.6×10^{7} m/s
18. 1.8 kg
19. 64:1
20. 17,190 years