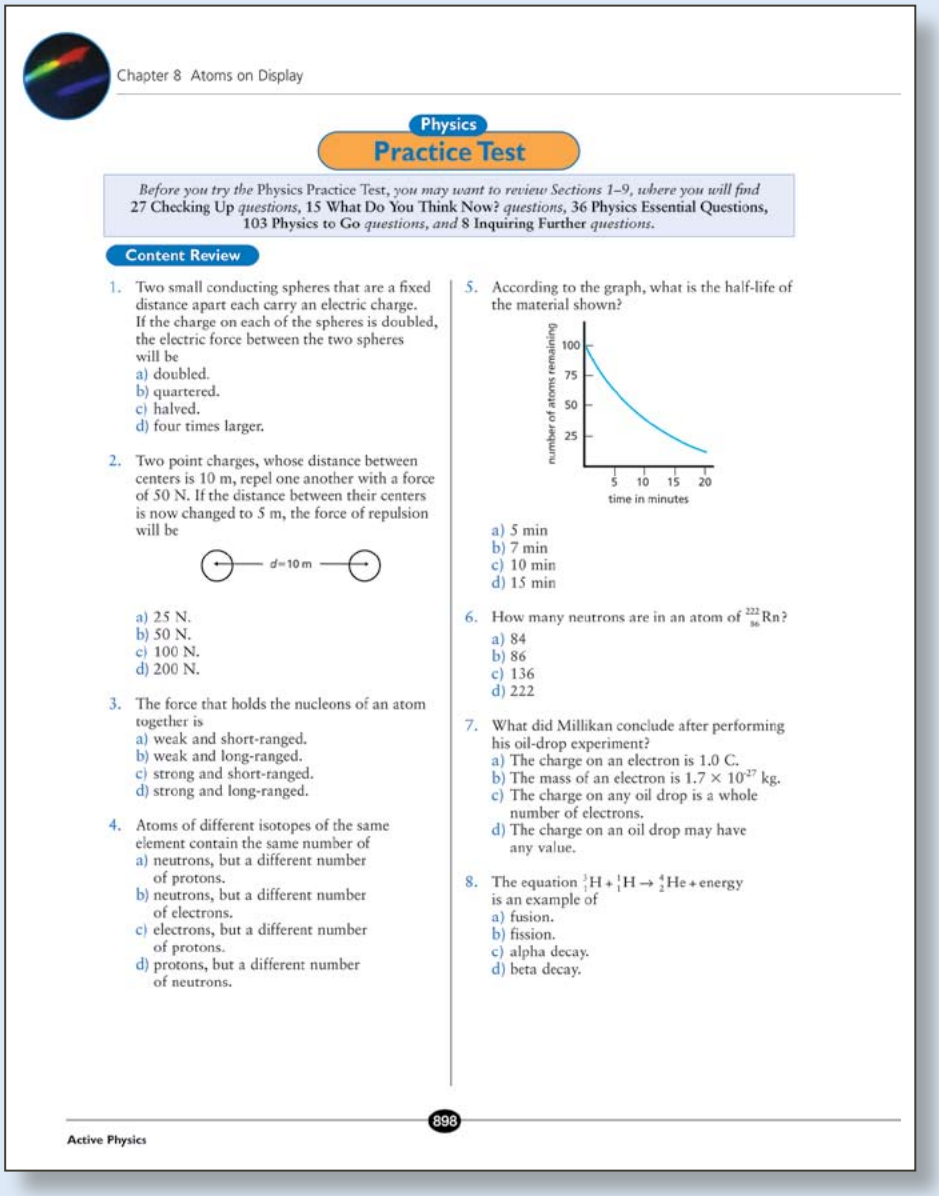
Physics Practice Test

The *Physics Practice Test* is provided as a Blackline Master in the *Teacher Resources* CD.

8b Blackline Master

Content Review

1. **d**
2. **d**
3. **c**
4. **d**
5. **b**
6. **c**
7. **c**
8. **a**



Chapter 8 Atoms on Display

Physics
Practice Test

Before you try the Physics Practice Test, *you may want to review Sections 1–9, where you will find* 27 Checking Up *questions,* 15 What Do You Think Now? *questions,* 36 Physics Essential Questions, 103 Physics to Go *questions, and* 8 Inquiring Further *questions.*

Content Review

1. Two small conducting spheres that are a fixed distance apart each carry an electric charge. If the charge on each of the spheres is doubled, the electric force between the two spheres will be
   a) doubled.
   b) quartered.
   c) halved.
   d) four times larger.

2. Two point charges, whose distance between centers is 10 m, repel one another with a force of 50 N. If the distance between their centers is now changed to 5 m, the force of repulsion will be

   d=10 m

   a) 25 N.
   b) 50 N.
   c) 100 N.
   d) 200 N.

3. The force that holds the nucleons of an atom together is
   a) weak and short-ranged.
   b) weak and long-ranged.
   c) strong and short-ranged.
   d) strong and long-ranged.

4. Atoms of different isotopes of the same element contain the same number of
   a) neutrons, but a different number of protons.
   b) neutrons, but a different number of electrons.
   c) electrons, but a different number of protons.
   d) protons, but a different number of neutrons.

5. According to the graph, what is the half-life of the material shown?

   a) 5 min
   b) 7 min
   c) 10 min
   d) 15 min

6. How many neutrons are in an atom of $^{222}_{86}Rn$?
   a) 84
   b) 86
   c) 136
   d) 222

7. What did Millikan conclude after performing his oil-drop experiment?
   a) The charge on an electron is 1.0 C.
   b) The mass of an electron is 1.7×10^{-27} kg.
   c) The charge on any oil drop is a whole number of electrons.
   d) The charge on an oil drop may have any value.

8. The equation $^{1}_{1}H + {}^{1}_{1}H \rightarrow {}^{4}_{2}He + \text{energy}$ is an example of
   a) fusion.
   b) fission.
   c) alpha decay.
   d) beta decay.

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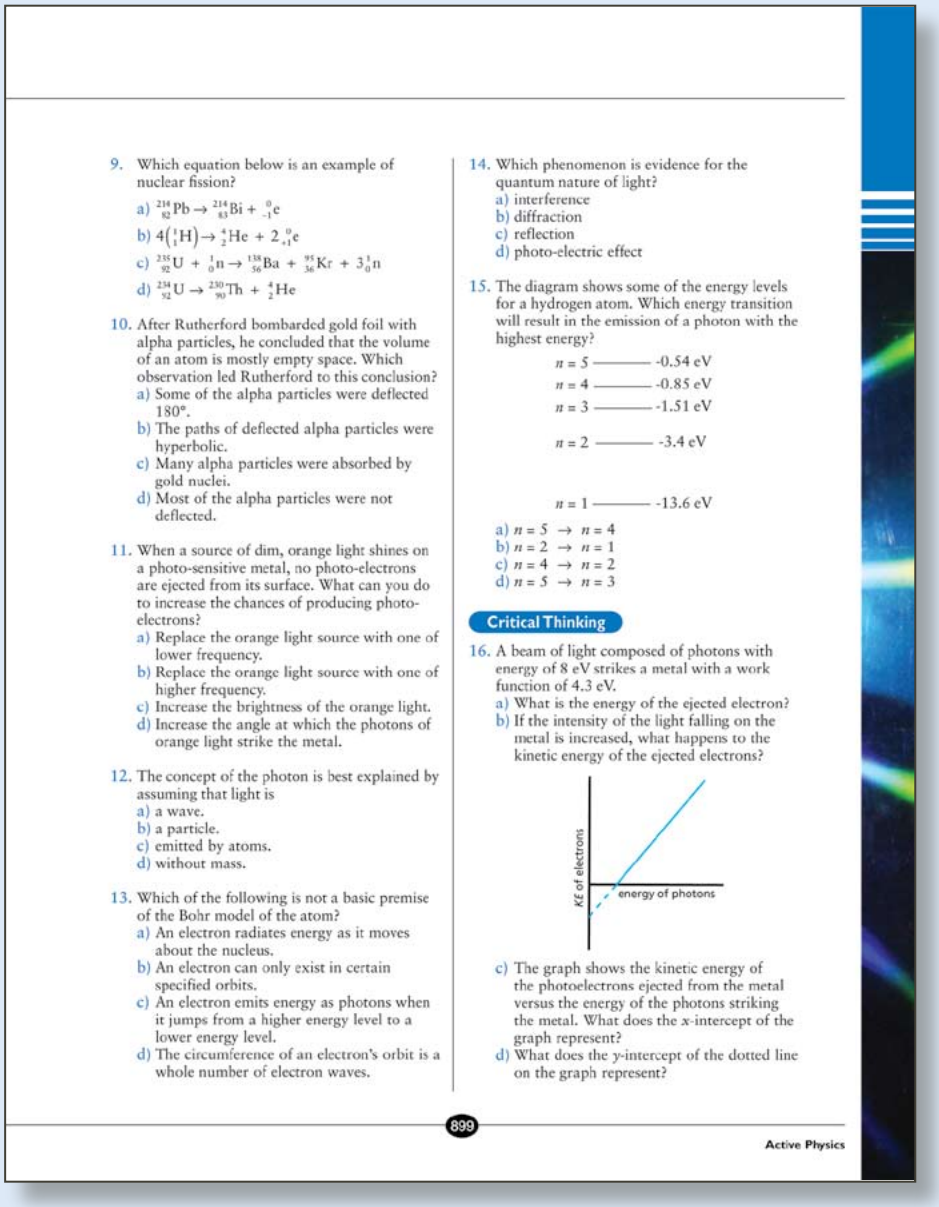
Active Physics



9. Which equation below is an example of nuclear fission?
   a) $^{214}_{82}\text{Pb} \rightarrow {}^{214}_{83}\text{Bi} + {}^{0}_{-1}\text{e}$
   b) $4\left({}^{1}_{1}\text{H}\right) \rightarrow {}^{4}_{2}\text{He} + 2\,{}^{0}_{+1}\text{e}$
   c) $^{235}_{92}\text{U} + {}^{1}_{0}\text{n} \rightarrow {}^{138}_{56}\text{Ba} + {}^{95}_{36}\text{Kr} + 3\,{}^{1}_{0}\text{n}$
   d) $^{234}_{92}\text{U} \rightarrow {}^{230}_{90}\text{Th} + {}^{4}_{2}\text{He}$

10. After Rutherford bombarded gold foil with alpha particles, he concluded that the volume of an atom is mostly empty space. Which observation led Rutherford to this conclusion?
   a) Some of the alpha particles were deflected 180°.
   b) The paths of deflected alpha particles were hyperbolic.
   c) Many alpha particles were absorbed by gold nuclei.
   d) Most of the alpha particles were not deflected.

11. When a source of dim, orange light shines on a photo-sensitive metal, no photo-electrons are ejected from its surface. What can you do to increase the chances of producing photo-electrons?
   a) Replace the orange light source with one of lower frequency.
   b) Replace the orange light source with one of higher frequency.
   c) Increase the brightness of the orange light.
   d) Increase the angle at which the photons of orange light strike the metal.

12. The concept of the photon is best explained by assuming that light is
   a) a wave.
   b) a particle.
   c) emitted by atoms.
   d) without mass.

13. Which of the following is not a basic premise of the Bohr model of the atom?
   a) An electron radiates energy as it moves about the nucleus.
   b) An electron can only exist in certain specified orbits.
   c) An electron emits energy as photons when it jumps from a higher energy level to a lower energy level.
   d) The circumference of an electron's orbit is a whole number of electron waves.

14. Which phenomenon is evidence for the quantum nature of light?
   a) interference
   b) diffraction
   c) reflection
   d) photo-electric effect

15. The diagram shows some of the energy levels for a hydrogen atom. Which energy transition will result in the emission of a photon with the highest energy?

$n = 5$ ——— -0.54 eV
$n = 4$ ——— -0.85 eV
$n = 3$ ——— -1.51 eV
$n = 2$ ——— -3.4 eV
$n = 1$ ——— -13.6 eV

   a) $n = 5 \rightarrow n = 4$
   b) $n = 2 \rightarrow n = 1$
   c) $n = 4 \rightarrow n = 2$
   d) $n = 5 \rightarrow n = 3$

Critical Thinking

16. A beam of light composed of photons with energy of 8 eV strikes a metal with a work function of 4.3 eV.
   a) What is the energy of the ejected electron?
   b) If the intensity of the light falling on the metal is increased, what happens to the kinetic energy of the ejected electrons?

   c) The graph shows the kinetic energy of the photoelectrons ejected from the metal versus the energy of the photons striking the metal. What does the *x*-intercept of the graph represent?
   d) What does the *y*-intercept of the dotted line on the graph represent?

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9. c

10. d

11. b

12. b

13. a

14. d

15. b

Critical Thinking

16.a)

Given:
$E_{\text{light}} = 8\text{ eV}$; $w_o = 4.3\text{ eV}$

$KE_{\text{electron}} = E_{\text{light}} - w_o =$
$8\text{ eV} - (4.3\text{ eV}) = 3.7\text{ eV}$

16.b)

The *KE* remains the same, but the number of electrons ejected increases.

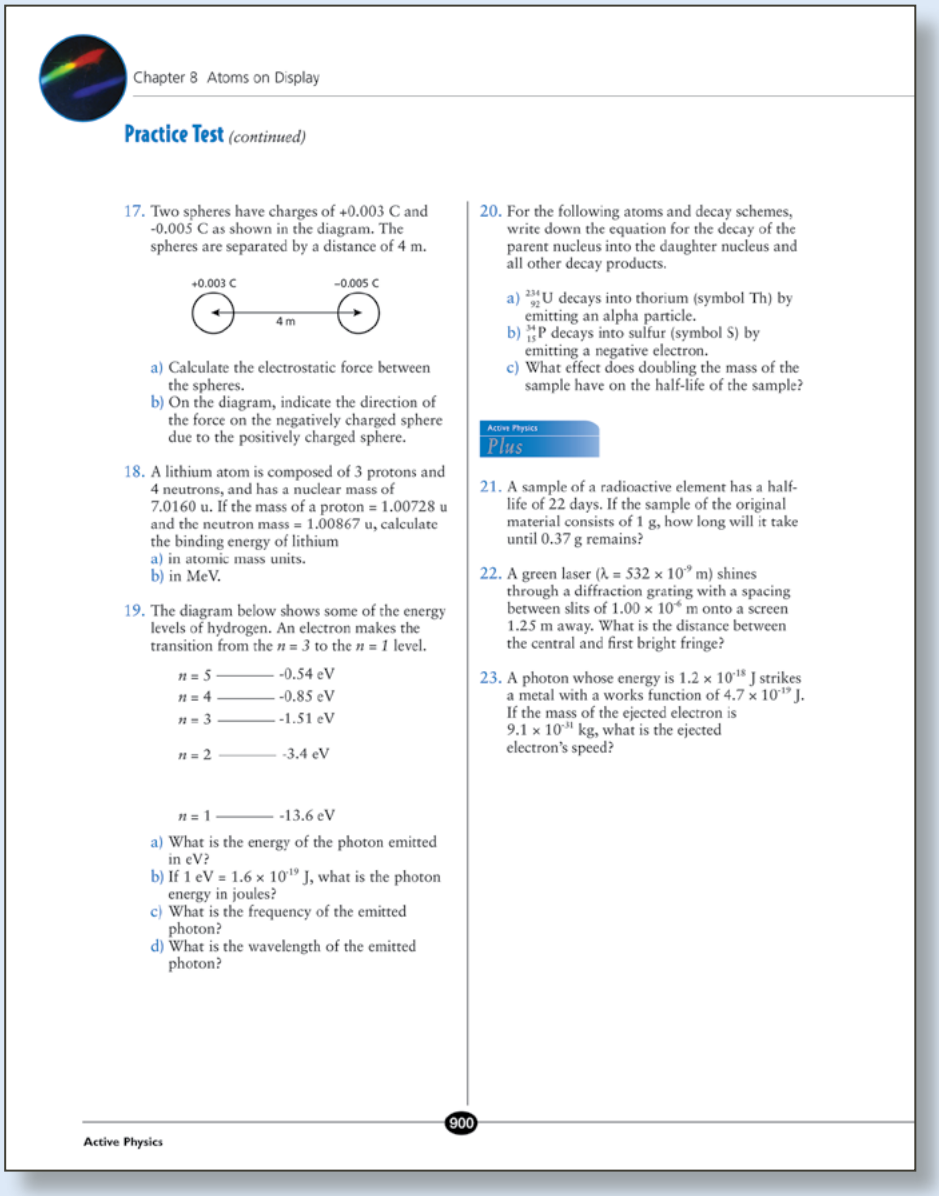
16.c)

The *x*-intercept is the minimum energy required to eject an electron.

16.d)

The *y*-intercept is the value of the work function of the metal.

CHAPTER 8



Practice Test *(continued)*

17. Two spheres have charges of +0.003 C and -0.005 C as shown in the diagram. The spheres are separated by a distance of 4 m.

a) Calculate the electrostatic force between the spheres.
b) On the diagram, indicate the direction of the force on the negatively charged sphere due to the positively charged sphere.

18. A lithium atom is composed of 3 protons and 4 neutrons, and has a nuclear mass of 7.0160 u. If the mass of a proton = 1.00728 u and the neutron mass = 1.00867 u, calculate the binding energy of lithium
a) in atomic mass units.
b) in MeV.

19. The diagram below shows some of the energy levels of hydrogen. An electron makes the transition from the $n = 3$ to the $n = 1$ level.

$n = 5$ ——— -0.54 eV
$n = 4$ ——— -0.85 eV
$n = 3$ ——— -1.51 eV

$n = 2$ ——— -3.4 eV

$n = 1$ ——— -13.6 eV

a) What is the energy of the photon emitted in eV?
b) If 1 eV = 1.6×10^{-19} J, what is the photon energy in joules?
c) What is the frequency of the emitted photon?
d) What is the wavelength of the emitted photon?

20. For the following atoms and decay schemes, write down the equation for the decay of the parent nucleus into the daughter nucleus and all other decay products.

a) $^{234}_{92}$U decays into thorium (symbol Th) by emitting an alpha particle.
b) $^{34}_{15}$P decays into sulfur (symbol S) by emitting a negative electron.
c) What effect does doubling the mass of the sample have on the half-life of the sample?

Active Physics
Plus

21. A sample of a radioactive element has a half-life of 22 days. If the sample of the original material consists of 1 g, how long will it take until 0.37 g remains?

22. A green laser ($\lambda = 532 \times 10^{-9}$ m) shines through a diffraction grating with a spacing between slits of 1.00×10^{-6} m onto a screen 1.25 m away. What is the distance between the central and first bright fringe?

23. A photon whose energy is 1.2×10^{-18} J strikes a metal with a works function of 4.7×10^{-19} J. If the mass of the ejected electron is 9.1×10^{-31} kg, what is the ejected electron's speed?

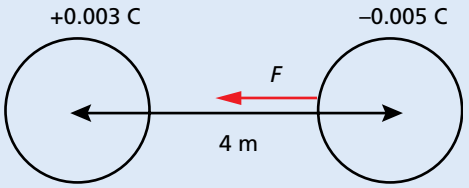
17.a)

Given:
$q_1 = +0.003$ C; $q_2 = -0.005$ C;
$d = 4$ m

$$F = \frac{kq_1q_2}{d^2} = \frac{\left[\left(9\times10^9\ \text{N}\cdot\text{m}^2/\text{C}^2\right)\left(0.003\ \text{C}\right)\times\left(-0.005\ \text{C}\right)\right]}{\left(4\ \text{m}\right)^2} =$$

-8400 N

17.b)



18.a)

$3(1.00728\ \text{u}) + 4(1.00867\ \text{u}) - 7.0160\ \text{u} = 0.0405\ \text{u}$

18.b)

$0.0405\ \text{u}(931.5\ \text{MeV/u}) = 37.7\ \text{MeV}$

19.a)

$\Delta E = E_1 - E_3 =$
$-13.6\ \text{eV} - (-1.51\ \text{eV}) =$
$-12.09\ \text{eV}$

19.b)

$\left(-12.09\ \text{eV}\right)\left(1.6\times10^{-19}\ \text{J/eV}\right) = -1.9\times10^{-18}\ \text{J}$

19.c)

Using $|\Delta E| = hf$, $f = |\Delta E|/h =$
$\left(1.9\times10^{-18}\ \text{J}\right)/\left(6.6\times10^{-34}\ \text{J}\cdot\text{s}\right) =$
2.9×10^{15} Hz

19.d)

Using $v = \lambda f$, $\lambda = v/f =$
$\left(3\times10^{8}\ \text{m/s}\right)/\left(2.9\times10^{15}\ \text{Hz}\right) =$
1×10^{-7} m

20.a)

$^{234}_{92}\text{U} \rightarrow {}^{230}_{90}\text{Th} + {}^{4}_{2}\text{He}$

20.b)

$^{34}_{15}\text{P} \rightarrow {}^{34}_{16}\text{S} + {}^{0}_{-1}\text{e}$

20.c)

Doubling the mass has no effect.

21. Active Physics Plus

Given:
half-life time, $t_{1/2} = 22$ days;
$N_o = 1$ g; $N = 0.37$ g

$2^n = N_o/N$
$n = \log(N_o/N)/\log(2) = 1.4344$
$t = n \times t_{1/2} = 31.5$ days

22. Active Physics Plus

Given:
$\lambda = 532\times10^{-9}$ m; $d = 1.00\times10^{-6}$ m;
$L = 1.25$ m

$$x = \frac{\lambda L}{d} = \frac{\left(532\times10^{-9}\ \text{m}\right)\left(1.25\ \text{m}\right)}{1.00\times10^{-6}\ \text{m}} = 0.67\ \text{m}$$

23. Active Physics Plus

Given:
$E_{\text{light}} = 1.2\times10^{-18}$ J;
$w_o = 4.7\times10^{-19}$ J;
$m = 9.1\times10^{-31}$ kg

$KE_{\text{electron}} = E_{\text{light}} - w_o =$
$1.2\times10^{-18}\ \text{J} - 4.7\times10^{-19}\ \text{J} =$
7.3×10^{-19} J
$KE_{\text{electron}} = mv^2/2$
$v = \sqrt{2KE_{\text{electron}}/m} = 1.3\times10^{6}$ m/s

CHAPTER 8

NOTES