Answers to Period 1 Exercises

E.1 **How many gallons of gasoline would each vehicle require to go 245 miles?**

(a) **50 miles on 2.25 gallons**

(b) **50 miles on 3.5 gallons**

(c) **50 miles on 6.5 gallons**

a) $\frac{2.25 \text{ gal}}{50 \text{ ~~miles~~}} \times 245 \text{ ~~miles~~} = 11.0 \text{ gal}$

b) $\frac{3.5 \text{ gal}}{50 \text{ ~~miles~~}} \times 245 \text{ ~~miles~~} = 17.2 \text{ gal}$

c) $\frac{6.5 \text{ gal}}{50 \text{ ~~miles~~}} \times 245 \text{ ~~miles~~} = 31.9 \text{ gal}$

E.2 **The British thermal unit (BTU) is a common unit of measurement for thermal energy. If one gallon of gasoline contains 126,000 BTU's, what is the energy content of 15.5 gallons of gasoline?**

a) 8.13×10^3 **BTU's**

b) 8.13×10^4 **BTU's**

c) 1.95×10^5 **BTU's**

d) 1.95×10^6 **BTU's**

e) 1.95×10^7 **BTU's**

$126{,}000 = 1.26 \times 10^5$

$$\frac{1.26 \times 10^5 \text{ BTUs}}{1 \text{ gal}} \times 15.5 \text{ gal} = 19.5 \times 10^5 \text{ BTUs}$$

19.5×10^5 BTUs $= 1.95 \times 10^6$ BTUs

E.2 = d

E.3 **What is the efficiency of an energy conversion process that requires 1,600 joules of energy and produces 400 joules of wasted energy?**

a) 25%

b) 30%

c) 50%

d) 75%

e) 400%

If 400 joules of wasted energy are produced, the useful energy is 1,600 J – 400 J = 1,200 J

$$\text{Efficiency} = \frac{\text{Useful Energy Out}}{\text{Total Energy In}} = \frac{1{,}200\ \text{J}}{1{,}600\ \text{J}}$$

$$= 3/4 = 75\%$$

E.3 = d

E.4 **Use the data in Table 1.2 to find when a population of 50,000 people, with an annual growth rate of 20%, will reach 1,600,000.**

a) 7.6 years

b) 15.2 years

c) 19.0 years

d) 22.8 years

e) 35.0 years

A 20% growth rate has a 3.8 yr doubling time

population now = 50,000

" in 3.8 yrs = 100,000

" in 7.6 yrs = 200,000

" in 11.4 yrs = 400,000

" in 15.2 yrs = 800,000

" in 19.0 yrs = 1,600,000

E.4 = c

E.5 **The return on an investment is 9% per year. If you invested $5,000 in 2002, how much will you have in 2026 if the annual growth rate remains constant?**

a) $15,000
b) $20,000
c) $25,000
d) $30,000
e) $40,000

From Table 1.2, a 9% growth rate has a doubling time of 8.0 years.

amount in 2002 = $5,000
" 2010 = $10,000
" 2018 = $20,000
" 2026 = $40,000

Or, use Equation 1.4, $N = B \times 2^a$

N = $5,000 x 2^3 = $5,000 x 8 = $40,000

E.5 = e

E.6 **The population of a rural area decreases by a factor of two every 20 years. If the population was 60,000 in 2000, what will the population be in 2040, assuming that the halving time remains the same?**

a) 45,000

b) 30,000

c) 25,000

d) 15,000

e) 7,500

population in 2000 = 60,000

" in 2020 = 30,000

" in 2040 = 15,000

Or, use Equation 1.5, $N = B \times 2^{-a}$

$N = 60{,}000 \times 2^{-2} = 60{,}000 \times 1/2^2 =$

$60{,}000 \times 1/4 = 15{,}000$

E.6 = d

E.7 **An electrical circuit has a current of 15 amps. How many electrons flow through this circuit each second? (Hint: An electron has a charge of 1.6×10^{-19} coulombs.)**

a) 2.4×10^{-20}

b) 9.4×10^{-19}

c) 15

d) 9.4×10^{19}

e) 2.4×10^{20}

15 amps = 15 coul/second

$$\frac{15 \text{ coul}}{1 \text{ second}} \times \frac{1 \text{ electron}}{1.6 \times 10^{-19} \text{ coul}} = 9.4 \times 10^{19} \frac{\text{electrons}}{\text{second}}$$

E.7 = d

E.8 **Which of the following sequences has the various regions of the electromagnetic spectrum arranged in order in increasing wavelength?**

a) infrared, visual, ultraviolet, gamma ray
b) radio, infrared, ultraviolet, X-ray
c) ultraviolet, visual, microwave, radio
d) X-ray, visual, microwave, infrared
e) gamma ray, X-ray, microwave, visual

E.8 = c

E.9 **Which of the following statements about the microwaves used in microwave ovens is FALSE?**

a) Microwaves are electromagnetic radiation.
b) Microwaves have the same wavelength as waves used in radio broadcasting.
c) Microwaves have wavelengths longer than those of visible light.
d) Microwaves heat food by the conversion of radiant energy into thermal energy.
e) Microwaves travel at the speed of light.

E.9 = b

Answers to Period 1 Exercises

E.1 **a) 11.0 gal**

b) 17.2 gal

c) 31.9 gal

E.2 **d**

E.3 **d**

E.4 **c**

E.5 **e**

E.6 **d**

E.7 **d**

E.8 **c**

E.9 **b**