

Period 9 Exercises

E.1 Joe weighs 900 N. He runs up a flight of steps in 3 seconds and stops on a landing a distance of 2 meters above ground level. How much power did Joe supply in doing work against gravity while climbing the stairs?

- a) 37.5 watts
- b) 600 watts
- c) 1350 watts
- d) 2160 watts
- e) 3600 watts

$$E_{pot} = M g h = 900 \text{ N} \times 2 \text{ m} = 1,800 \text{ J}$$

$$P = \frac{E}{t} = \frac{1,800 \text{ J}}{3 \text{ s}} = 600 \text{ J/s} = 600 \text{ W}$$

E.1 = b

E.2 Suppose you climb a 10 ft. stairway in 3 seconds and then you climb a 20 ft. stairway in 6 seconds. Which of the following statements about the work done against the force of gravity and the power required for this work is TRUE?

- a) You used **twice as much energy** and required **twice as much power** to climb the 20 ft. stairway as you did to climb the 10 ft. stairway.
- b) You used **twice as much energy** but required the **same amount of power** to climb the 20 ft. stairway as you did to climb the 10 ft. stairway.
- c) You used the **same amount of power and energy** to climb both stairways.
- d) It is impossible to compare the power required for each stairway unless you know your weight.

The amount of energy required depends on the height of the stairway: $E_{pot} = M g h$
Doubling the height of the stairs doubles the energy.

$P = E/t$: Since the energy **and** the time required both double, the power remains the same. **E.2 = b**

E.3 Power is

- a) force times the distance moved.
- b) the rate of transfer of energy.
- c) energy measured in calories.
- d) what you are charged for by the electric power company.
- e) all of the above.

E.3 = b

E.4 If your electric company charges 8 cents per kilowatt hour for electricity, how much would you pay to operate a 100 watt bulb for 20 hours?

- a) \$2.50
- b) \$0.40
- c) \$0.16
- d) \$0.016
- e) None of the above is correct.

$$\frac{\$0.08}{\text{kWh}} \times 100 \cancel{\text{ W}} \times \frac{1 \cancel{\text{ kW}}}{1000 \cancel{\text{ W}}} \times 20 \cancel{\text{ hr}} = \$0.16$$

E.4 = c

E.5 Suppose you leave two incandescent lights on for 1 hour: a 100 watt desk lamp and 50 watt aquarium light. Which statement is true?

- a) The 100 watt desk lamp uses **more energy** than the 50 watt light.
- b) The 100 watt desk lamp requires **less power** than the 50 watt light.
- c) They both use the **same amount of energy**, but the desk lamp **uses more power**.
- d) In general, the 100 watt desk lamp gives off **less light** than the 50 watt light.

E.5 = a

E.6 If your monthly electric bill is \$75.00 and you have used 1500 kWh of energy, what is your cost per kilowatt hour?

- a) \$0.20
- b) \$0.15
- c) \$0.10
- d) \$0.05
- e) \$0.02

$$\$75.00 \times \frac{1}{1500 \text{ kWh}} = \frac{\$0.05}{\text{kWh}}$$

E.6 = d

E.7 You are deciding between two brands for your new refrigerator. The Kwik Frost costs \$500 to purchase and \$110 per year to operate. The Kool Master costs \$550 to purchase and \$65 per year to operate. If you choose the Kool Master, how much money will you save after 1 year? How much after 5 years?

Cost after 1 year:

$$\text{Kwik Frost} = \$500 + (\$110/\text{yr} \times 1 \text{ yr}) = \$610$$

$$\text{Kool Mast} = \$550 + (\$65/\text{yr} \times 1 \text{ yr}) = \$615$$

No savings – the Kool Master costs \$5 more

Cost after 5 years:

$$\text{Kwik Frost} = \$500 + (\$110/\text{yr} \times 5 \text{ yr}) = \$1050$$

$$\text{Kool Mast} = \$550 + (\$65/\text{yr} \times 5 \text{ yr}) = \$875$$

Kool Master saves \$175

E.8 If electricity costs \$0.07 per kilowatt-hour, how much energy (in kilowatt-hours) will you save each year by choosing the Kool Master refrigerator in question E.7?

$$\begin{aligned} \text{The difference in operating costs/yr} &= \\ \$110 - \$65 &= \$45 \end{aligned}$$

$$\begin{aligned} \cancel{\$45} \times \frac{1 \text{ kWh}}{\cancel{\$0.07}} &= 643 \text{ kWh} \end{aligned}$$

Solutions to Period 9 Exercises

E.1 = b

E.2 = b

E.3 = b

E.4 = c

E.5 = a

E.6 = d

E.7 Kool Master costs \$5 more after 1 year.
Kool Master saves \$175 after 5 years.

E.8 = 643 kWh