Work and Energy

ADDITIONAL PRACTICE F

Givens	*Solutions*
1. $P = 56$ MW $\Delta t = 1.0$ h	$W = P\Delta t = (56 \times 10^6 \text{ W})(1.0 \text{ h})(3600 \text{ s/h}) = \boxed{2.0 \times 10^{11} \text{ J}}$
2. $\Delta t = 62.25$ min $P = 585.0$ W	$W = P\Delta t = (585.0 \text{ W})(62.25 \text{ min})(60 \text{ s/min}) = \boxed{2.185 \times 10^6 \text{ J}}$
3. $h = 106$ m $m = 14.0$ kg $g = 9.81 \text{ m/s}^2$ $P = 3.00 \times 10^2$ W $\theta = 0°$	$W = F_g d(\cos\theta) = F_g d = mgh$ $\Delta t = \frac{W}{P} = \frac{mgh}{P} = \frac{(14.0 \text{ kg})(9.81 \text{ m/s}^2)(106 \text{ m})}{3.00 \times 10^2 \text{ W}} = \boxed{48.5 \text{ s}}$
4. $P = 2984$ W $W = 3.60 \times 10^4$ J	$\Delta t = \frac{W}{P} = \frac{3.60 \times 10^4 \text{ J}}{2984 \text{ W}} = \boxed{12.1 \text{ s}}$
5. $\Delta t = 3.0$ min $W = 54$ kJ	$P = \frac{W}{\Delta t} = \frac{54 \times 10^3 \text{ J}}{(3.0 \text{ min})(60 \text{ s/min})} = \boxed{3.0 \times 10^2 \text{ W}}$
6. $\Delta t = 16.7$ s $h = 18.4$ m $m = 72.0$ kg $g = 9.81 \text{ m/s}^2$ $\theta = 0°$	$W = F_g d(\cos\theta) = mgh$ $P = \frac{W}{\Delta t} = \frac{mgh}{\Delta t} = \frac{(72.0 \text{ kg})(9.81 \text{ m/s}^2)(18.4 \text{ m})}{16.7 \text{ s}}$ $P = \boxed{778 \text{ W}}$

Name:____________________________ Class:_________________ Date:_________________

Work and Energy

Problem F

POWER

PROBLEM

Martinus Kuiper of the Netherlands ice skated for 24 h with an average speed of 6.3 m/s. Suppose Kuiper's mass was 65 kg. If Kuiper provided 520 W of power to accelerate for 2.5 s, how much work did he do?

SOLUTION

Given: $P = 520$ W

$\Delta t = 2.5$ s

Unknown: $W = ?$

Use the equation for power and rearrange it to solve for work.

$$P = \frac{W}{\Delta t}$$

$$W = P\Delta t = (520 \text{ W})(2.5 \text{ s}) = 1300 \text{ J}$$

ADDITIONAL PRACTICE

1. The most powerful ice breaker in the world was built in the former Soviet Union. The ship is almost 150 m long, and its nuclear engine generates 56 MW of power. How much work can this engine do in 1.0 h?
2. Reginald Esuke from Cameroon ran over 3 km down a mountain slope in just 62.25 min. How much work was done if the power developed during Esuke's descent was 585.0 W?
3. The world's tallest lighthouse is located in Japan and is 106 m tall. A winch that provides 3.00×10^2 W of power is used to raise 14.0 kg of equipment to the lighthouse top at a constant velocity. How long does it take the equipment to reach the lighthouse top?
4. The first practical car to use a gasoline engine was built in London in 1826. The power generated by the engine was just 2984 W. How long would this engine have to run to produce 3.60×10^4 J of work?
5. Dennis Joyce of the United States threw a boomerang and caught it at the same location 3.0 min later. Suppose Joyce decided to work out while waiting for the boomerang to return. If he expended 54 kJ of work, what was his average power output during the workout?
6. In 1984, Don Cain threw a flying disk that stayed aloft for 16.7 s. Suppose Cain ran up a staircase during this time, reaching a height of 18.4 m. If his mass was 72.0 kg, how much power was needed for Cain's ascent.