Name SOLUTIONS Date

106 Mechanical Energy Practice

$PE = mgh$ $KE = \frac{1}{2} mv^2$

1) A 25 kg object is held at 3 m above the ground. What is its potential energy?

$m = 25kg$
$h = 3m$
$PE = ?$

$PE = mgh$
$PE = (25)(9.8)(3)$
$PE = \boxed{735 J}$

2) A 100 kg object has a potential energy of 14,700 J. How high off the ground is it?

$m = 100kg$
$PE = 14,700J$
$h = ?$

$PE = mgh$
$14700 = (100)(9.8)h$
$14700 = 980h$
$\frac{14700}{980} = h = \boxed{15m}$

3) An object has a potential energy of 1000 J. The object is 5 m off the ground. What is its mass?

$PE = 1000 J$
$h = 5m$
$m = ?$

$PE = mgh$
$1000 = m(9.8)(5)$
$1000 = m(49)$
$\frac{1000}{49} = m = \boxed{20.4kg}$

4) A 20 kg mass is moving at 10 m/s. What is its kinetic energy?

$m = 20kg$
$V = 10\frac{m}{s}$
$KE = ?$

$KE = \frac{1}{2}mv^2$
$KE = \frac{1}{2}(20)(10)^2$
$KE = (10)(100)$
$KE = \boxed{1000 J}$

Answers: 1) 735 J 2) 15 m 3) 20.4 kg 4) 1000 J

5) A 25 kg mass has a kinetic energy of 1250 J. What is its speed?

$m = 25\,kg$

$KE = 1250\,J$

$v = ?$

$KE = \frac{1}{2}mv^2$

$1250 = \frac{1}{2}(25)v^2$

$1250 = 12.5\,v^2$

$\frac{1250}{12.5} = v^2$

$\sqrt{100} = v = \boxed{10\,m/s}$

6) An object moving at 50 m/s has a kinetic energy of 5000 J. What is its mass?

$v = 50\,\frac{m}{s}$

$KE = 5000\,J$

$m = ?$

$KE = \frac{1}{2}mv^2$

$5000 = \frac{1}{2}m(50)^2$

$5000 = \frac{1}{2}m(2500)$

$5000 = 1250\,m$

$\frac{5000}{1250} = m = \boxed{4\,kg}$

7) A 70 kg snowboarder is at the top of a 100 m mountain. Before the snowboarder begins to move,

a) what is their potential energy?

$m = 70\,kg$

$h = 100\,m$

$PE = ?$

$v = 0\,m/s$

$PE = mgh$

$PE = (70)(9.8)(100)$

$PE = \boxed{68{,}600\,J}$

b) What is their kinetic energy?

$KE = \frac{1}{2}mv^2$

$KE = \frac{1}{2}(70)(0)^2$

$KE = \boxed{0\,J}$

c) What is their total energy?

$TE = KE + PE$

$TE = 0 + 68{,}600$

$TE = \boxed{68{,}600\,J}$

Answers: 5) 10 m/s 6) 4 kg 7a) 68600 J b) 0 J c) 68600 J

8) When the snowboarder has reached a point where they are 40 m vertically above the ground,

a) what is their potential energy?

$m = 70\,kg$

$h = 40\,m$

$PE = ?$

$PE = mgh$

$PE = (70)(9.8)(40)$

$PE = \boxed{27{,}440\ J}$

b) What is their total energy?

$TE = \boxed{68{,}600\ J}$

(STAYS CONSTANT THROUGHOUT)

c) What is their kinetic energy?

$TE = KE + PE$

$68{,}600 = KE + 27{,}440$

$68{,}600 - 27{,}440 = KE$

$\boxed{41{,}160\ J} = KE$

d) What is their speed?

$KE = \frac{1}{2}mv^2$

$41{,}160 = \frac{1}{2}(70)v^2$

$41{,}160 = 35v^2$

$\sqrt{\frac{41{,}160}{35}} = v = \boxed{34.3\ m/s}$

Answers: 8a) 27440 J b) 68600 J c) 41160 J d) 34.3 m/s

9) When the snowboarder has reached the ground,

a) what is their potential energy?

$m = 70\,kg$ $\quad PE = mgh$

$h = 0\,m$ $\quad PE = (70)(9.8)(0)$

$PE = ?$ $\quad PE = \boxed{0\ J}$

b) What is their total energy?

$TE = \boxed{68{,}600\ J}$

(STAYS CONSTANT THROUGHOUT)

c) What is their kinetic energy?

$TE = KE + PE$

$68{,}600 = KE + 0$

$\boxed{68{,}600J} = KE$

d) What is their speed?

$KE = \frac{1}{2}mv^2$

$68{,}600 = \frac{1}{2}(70)v^2$

$68{,}600 = 35v^2$

$\sqrt{\frac{68{,}600}{35}} = v = \boxed{44.27\ m/s}$

Answers: 9a) 0 J b) 68600 J c) 68600 J d) 44.27 m/s