Mastin 2019

**Unit 12 Energy Test Review** KEY **Mastin 2019**

**NAME:**_____

**Work has a special meaning in science. It is the product of the force applied to an object and the distance the object moves. The unit of work is the Joule (J)**

**Work = Force x Distance**

**W= F x d Work = joules (J) Force = Newtons (N) Distance = meters (m)**

1. A book weighing 1.0 Newton is lifted 2 meters. How much work was done?

   2J

2. A force of 15 Newtons is used to push a box along the floor a distance of 3 meters. How much work was done?

   45 J

3. It took 50 joules to push a chair 5 meters across the floor. With what force was the chair pushed?

   50 J = 5 x F

   10N = F

4. A force of 100 Newtons was necessary to lift a rock. A total of 150 joules of work was done. How far was the rock lifted?

   150 J = 100 N x d

   1.5 m

5. It took 500 Newtons of force to push a car 4 meters. How much work was done?

   500 x 4 = 2000 J

6. A young man exerted a force of 9,000 N on a stalled car but was unable to move it. How much work was done?

   9,000N → no distance

   no work

**Calculating Power**

**Power is the amount of work done per unit of time. The unit for power, joules/second, is the watt.**

**Power =work/time**

1. A set of pulleys is used to lift a piano weighing 1,000 Newtons. The piano is lifted 3 meters in 60 seconds. How much power is used?

   3,000 J = W = 3,000 J / 60s

   = 50W

2. How much power is used if a force of 35 Newtons is used to push a box a distance of 10 meters in 5 seconds?

   35 x 10 = 350 J

   350 J / 5s = 70W

3. What is the power of a kitchen blender if it can perform 3,750 joules of work in 15 seconds?

   3,750 / 15 = 250W

4. How much work is done using a 500-watt microwave oven for 5 minutes.

   500W = W / 300s = 150,000J

5. 5. How much work is done using a 60-watt light bulb for 1 hour?

   W = f x d

   P = W / t

   1hr | 60min | 60s

   1hr | 1min

   60W = W / 3600s

   21,600J

## Kinetic and Potential Energy

**PE = mgh** **KE = ½ mv²**

**Potential Energy (due to gravity)**

1) A 2.4 kg toy falls from 2 m to 1 m. What is the change in Potential Energy?

PE = (2.4kg)(9.8)(1) → x2m

23.52 J | = 47.04 J

ΔPE = 23.52 J

2) If (on earth) an object falls 18 m and loses 36 J of PE. What is the object's mass?

36 J = (18 m)(9.8 m/s²)(m)

0.20 kg

3) A 1 Kg object loses 20 J of GPE as it falls. How far does it fall?

20 J = (1kg)(9.8 m/s²)(h)

2.04 m ← h

4) A small, 3 kg weight is moved from 5 m from the ground to 8 m. What is the change in potential energy?

(3kg)(9.8)(5) = 147 J

(3kg)(9.8)(8) = 235.2 J

ΔPE = 88.2 J

5) An 80 kg person falls 60 m off of a waterfall. What is her change in PE?

(80kg)(60m)(9.8) | = 47,040 J

6) A Potential Energy (PE) Sensor attached to a 12 Kg ball changes from 12 J to 22 J, by height change alone. What is the change in height?

22 J − 12 J = 10 J ΔPE

10 J = (12kg)(9.8)(h) = 0.09 m

7) A man rides up in an elevator 12 m. He gains 6500 J of potential energy due to gravity. What is the man's mass?

6500 J = (m)(12m)(9.8)

55.27 kg

8) When a 5 kg rock is dropped from a height of 6 m on Planet X, it loses 24 J of GPE. What is the acceleration due to gravity on Planet X?

PE = mgh

24 J = (5kg)(g)(6m) = 30 = .08 m/s²

9) What is the gravitational potential energy of a 450 Kg car at the top of a 25 m parking garage?

PE = (450 kg)(25m)(9.8)

PE = 110,250 J

10) What is the change in gravitational potential energy of a 45 kg weight that is moved from 2 m to 18 m on earth? What is it on the moon (g = 1.6 m/s²)?

18 − 2 = 16m

= (45kg)(16)(16)m

= 11152 J

11) A 0.25 kg book falls off a 2 m shelf on to a 0.5 m chair. What was the change in GPE?

2 − (0.5m) = 1.5m

PE = (.25kg)(1.5)(9

3.675 J

12) A 60 kg girl falls off of a waterfall and looses 10 kJ of GPE. What was her height?

10KJ = 10,000 J

10,000 J = (60 kg)(9.8)(h)

h = 17.01 m

13) When a 0.5 kg rock is dropped from a height of 12 m on Planet Z, it loses 45 J of GPE. What is the acceleration due to gravity on Planet Z?

GPE = mgh

45 J = (.5kg)(12m)(g)

7.5 m/s² = g

**Kinetic Energy**

14) How much kinetic energy does an 80 kg man have while running at 1.5 m/s?

KE = mv²/2

(80kg)(1.5²)/2

90 J

15) A bird flies at a speed of 2.3 m/s if it has 14 J of kinetic energy, what is its mass?

14 J = m(2.3²)/2

2. 14 J = 5.29 m·2 /2

28 J = 5.29m / 5.29 5.29

5.29 kg

16) A child does 12 J of work pushing his 3 kg toy truck. With what velocity does the toy move after the child is done pushing?

$2 \cdot 12J = \frac{(3kg)(v^2)}{2} \cdot 2$ $\quad W = Fxd$ $\quad v = \frac{d}{t}$ $\quad \frac{1}{2}mv^2$ $\quad K = \frac{mv^2}{2}$

$24J = 3kg\,v^2$ $\quad P = \frac{W}{t}$ $\quad 12J = \frac{(3kg)(v^2)}{2}$

$\sqrt{8} = \sqrt{v^2}$ $\quad 24J = 12v^2$

$V = 2.83 m/s$

17) A 6 kg object has a speed of 24 m/s. What is its kinetic energy?

$KE = \frac{(6kg)(24m/s^2)}{2}$ $\quad KE = 1728J$

18) A rock hits the ground with a speed of 7 m/s and a kinetic energy of 100 J. What is the rock's mass?

$100J = \frac{m(7^2)}{2} \rightarrow \frac{200J}{49} = \frac{49m}{49}$ $\quad m = 4.08 kg$

19) A bullet is fired into a 12 kg block of wood. After the bullet stops in the block of wood the block has 29 J of kinetic energy. At what speed is the block moving?

$2 \cdot 29J = \frac{(12kg)(v^2)}{2} \cdot 2$ $\quad \frac{58J}{12} = \frac{(12kg)(v^2)}{12}$ $\quad \sqrt{4.83} = \sqrt{v^2}$

$V = 2.197 \Rightarrow 2.20 m/s$

20) How much kinetic energy does a 4 Kg cat have while running at 9 m/s?

$KE = \frac{(4kg)(9m/s^2)}{2}$ $\quad KE = 162J$

21) What is the mass of an object moving with a speed of 4 m/s and a kinetic energy of 2000 J?

$2 \cdot 2{,}000J = \frac{(m)(4^2)}{2} \cdot 2 \rightarrow 4{,}000J = 8m$

$= 250 kg$

22) A 400 Kg car has 1.8 x 105 (correction) 1.8 x 105 J of kinetic energy. How fast is it moving?

$2 \cdot 1.8 \times 10^5 J = \frac{(400kg)(v^2)}{2} \cdot 2 \rightarrow 360{,}000J = (400kg)(v^2)$

$\sqrt{\frac{900 J}{kg}} = \sqrt{v^2}$ $\quad V = 30 m/s$

23) How fast is a 3 Kg toy car with 20 J of kinetic energy moving?

$20J = \frac{(3kg)(v^2)}{2}$ $\quad 40J = (30kg)(v^2)$ $\quad = 1.14 m/s$

24) A student runs to physics class with a speed of 6 m/s. If the student has 880 J of kinetic energy, what is her mass?

$2 \cdot 880J = \frac{(m)(6m/s)^2}{2} \cdot 2$

$1760J = 36m$

$48.89kg = m$