Physics Honors
2020-21

Work & Energy

Name _____
Period _____

$PE = mgh$ $KE = \frac{1}{2}mv^2$ $W = Fd$ $F_g = mg$

1. Which of the following are examples of either Potential Energy (PE) or kinetic Energy (KE)?

PE A. Energy stored in stretched rubber bands.

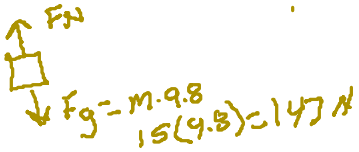
KE B. Energy of a bullet moving 350 m/s. Maybe PE if above the ground

PE C. Energy of gun powder. Chemical PE

PE D. A can of soup sitting on a shelf 1.5 m above floor.

KE E. A can of soup that has fallen from the shelf and is about to hit your toe. PE ≈ 0

2. How much work must be done to lift a 15 kg case of soup to a grocery shelf 0.75 m above the floor?



W = F*d
W = 147*0.75 = 110 J

3. How much work does the shelf do holding the case of soup up? Explain.

No work is done because there is no displacement.

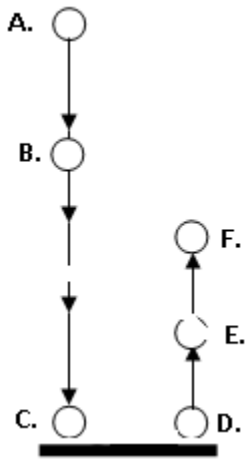
4. What is the potential energy of a 0.4 kg can of soup sitting on a 3 m high shelf?

PE = mgh
PE = (0.4)(9.8)(3)
PE = 11.8 Joules

5. What is the kinetic energy of a .5 kg can of soup that is rolling across the floor at a speed of 2.5 m/s?

$KE = \frac{1}{2} \cdot m \cdot v^2$ $KE = \frac{1}{2}(0.5)(2.5)^2 = 1.56 \cdot J$

6. A ball is dropped from 2.00 m, hits the ground and bounces 1.00 m high. Label the types of energy (PE, KE) found at the different places A-F:



A: PE , KE=0

B: PE + KE

C: KE, PE ≈ 0

D: PE ≈ 0 and KE

E: PE + KE

F: PE, KE = 0

7. What can be said about the total mechanical energy in the path from A-C compared to the path from D-F; is it more, less, or the same? If they are different, why?

TME is PE + KE which is larger from A-C because D-F has less final height. When the ball bounces it stores energy elastically then releases it. This is not a 100% efficient process. Energy is lost to the environment.

Work & Energy

8. A student lifts 25 kg barbell above their head in gym class. In doing so, the barbell gains 368 Joules of potential energy. How high did they lift the weights?

$$PE = m \cdot g \cdot h$$
$$368 = 25 \cdot 9.8 \cdot h$$
$$368 = 245 \cdot h$$
$$\frac{368}{245} = h$$
$$h = 1.5m$$

9. A 2.5 kg cart has a kinetic energy of 125 Joules. What is its velocity?

$$KE = \frac{1}{2} \cdot m \cdot v^2$$
$$125 = \frac{1}{2} \cdot 2.5 \cdot v^2$$
$$125 = 1.25 \cdot v^2$$
$$v^2 = \frac{125}{1.25} = 100$$
$$v = \sqrt{100} = 10 \cdot \frac{m}{s}$$

Work & Energy

Total Mechanical Energy Examples:

For the following objects at the given speeds and heights (above a given reference level) calculate the potential, kinetic and total energies

Remember $\boldsymbol{TME = PE + KE}$ $PE = mgh$ $KE = \frac{1}{2}mv^2$

Object	Speed (m/s)	Height (m)	Mass (kg)	P.E.(J)	K.E. (J)	T.M.E.(J)
Rock	0	0	0.5	PE=0	KE=0	PE + KE = 0
Large Boulder	0	12	2,000		0	
Cheetah	24	1.5	60			
Space Shuttle	300	20,000	40,000			
Submarine	40	100	2,500			
Runner	2	1	75			
Fly	10	3	0.004			

For the objects below, calculate the unknown values using your knowledge of energy

Object	Speed (m/s)	Height (m)	Mass (kg)	P.E.(J)	K.E. (J)	T.M.E.(J)
Lead Block			50		4,000	7,500
Car	14		1,800	7,200		
Unknown	1,000	0				400,000
Truck			6,400	7,200		183,600
Laundry Bag		10		700		2,000
Unknown		3	100		463.3	