CALCULATING GRAVITATIONAL POTENTIAL ENERGY

WRITE THE FORMULA TO WORK OUT GRAVITATIONAL POTENTIAL ENERGY

$$m = \frac{E_{GP} = \frac{M}{x} \times \frac{9}{x} \frac{h}{h}}{g = \frac{granty(q,8)}{m/s^n}} = \frac{height(m)}{h}$$

CALCULATE THE GPE OF THE FOLLOWING OBJECTS

1. A rollercoaster is at the top of a 72m hill and has a mass of 966kg.

Mass =
$$966$$
 Gravity = 9.8 Height = 72 GPE = $966 \times 9.8 \times 72$ = $681,609.6$

2. There is a bell at the top of a tower that is 45m high. The bell weighs 190kg. Calculate its GPE.

Mass =
$$(90)$$
 Gravity = 9.8 GPE = $190 \times 9.8 \times 45$

Height =
$$45$$
 = $83,790$ J

Mass =
$$0 t$$

Gravity =
$$9.8$$

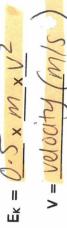
4. A child is sitting on the ground. Do they have any GPE? $\overline{\mathcal{M}\mathcal{O}}$

Give a reason for your answer: NOT above the ground

CALCULATING KINETIC ENERGY

WRITE THE FORMULA TO WORK OUT KINETIC ENERGY

$$m = \frac{E_K = 0.5 \times m \times V^2}{v = velocity(m/s)}$$



CALCULATE THE KINETIC ENERGY OF THE FOLLOWING OBJECTS

1. A car is travelling with a speed of 40m/s and has a mass of 1120kg. Calculate its kinetic energy.

Mass =
$$1/20$$
 Speed = 40
Kinetic energy = $0.5 \times 1/20 \times 40^2$ = $896,000$ J



2. You serve a volleyball with a mass of 2.1kg. The ball leaves your hand with a speed of 30m/s. Calculate its kinetic energy.

Mass =
$$2$$
/ Speed = 30
Kinetic energy = $0.5 \times 2.1 \times 30^2 = 945$

3. A dolphin is swimming at a speed of 20m/s and has a mass of 110kg. Calculate its kinetic energy.

Mass =
$$1/0$$
 Speed = 20
Kinetic energy = $0.5 \times 110 \times 20^2$





KINETIC ENERGY Calculations Worksheet

- ✓ The formula for calculating kinetic energy is: $0.5 \times M \times V^2$
- ✓ The two factors that determine the amount
 of kinetic energy in an object are

mass and velocity

- ✓ Kinetic energy is measured in units of:
- ✓ Mass must be measured in units of:
- ✓ Velocity must be measured in units of
- 1. A shot putter heaves a 7.26kg shot with a final velocity of 7.5m/s. What is the kinetic energy of the shot?

$$E_{K} = 0.5 \times 7.26 \times 7.5^{2}$$

= 204.19J

 A bike rider approaches a hill with a speed of 8.5m/s. The total mass of the rider and the bike is 85kg. Find the kinetic energy of the bike and rider.

3. What is the kinetic energy of a ball with a mass of 5 kg rolling at 10 m/s?

4. What kinetic energy has a 2560kg car travelling at 15 m/s?

$$E_{k} = 0.5 \times 2560 \times 15^{2}$$

= 288,000 J

5. How much kinetic energy has a 5 gram bullet speeding at 100 m/s?

$$E_{\kappa} = 0.5 \times 0.05 \times 100^{2}$$

6. What kinetic energy has a 4 kg shotput thrown with a velocity of 13 m/s?

$$E_{K} = 0.5 \times 4 \times 13^{2}$$

= 338 J

7. Calculate the kinetic energy a 12kg rock rolling down a hill with a velocity of 8 m/s.

8. Calculate the kinetic energy of a truck that has a mass of 2900 kg and is moving at 55 m/s.

$$Eu = 0.5 \times 2900 \times 55^2$$

= 4,386,250J

9. Find the mass of a car that is travelling at a velocity of 60 m/s North. The car has 5,040,000 J of kinetic energy.

- 10. Determine whether work is being done in each of the following examples: (yes/no)
- a. a train engine pulling a loaded boxcar initially at rest _____
- b. a tug of war that is evenly matched NO
- c. a crane lifting a car ______
- 11. A 1.12kg coconut falls at 3.3m/s from its tree. How much KE does that coconut have while it is falling?

$$E_{k} = 0.5 \times 1.12 \times 3.3^{2}$$

= 6.1J

12. How much kinetic energy does an object have if it 56kg and is travelling at 15m/s?

$$E_{K} = 0.5 \times 56 \times 15^{2}$$

= 6300J

B-B-B-B-B-B-B-BIDETTIC ENERGY CALCULATIONS

1. Kinetic energy can be defined as:

Energy of movement

- 2. The equation to be used to calculate kinetic energy (Ek) is: 0,5 x m x v 2
- 3. The unit in which Ek is often measured is the :
- 4. Rodger swung a bat which had a mass of 2kg at a velocity of 45 m/s.

How many joules of kinetic energy could he give to a ball?

5. Barry swings a bat which has a mass of 1.5 Kg at a velocity of 55 m/s.

How many joules of kinetic energy could he give to a ball?

6. What TWO FACTORS could INCREASE the

KE of an object?

4 mass, 4 velocity

7. A golf pro swings his driver which weighs 0.75 kg at a velocity of 60 m/s.

Calculate the kinetic energy of the club.

$$E_{K} = 0.5 \times 0.75 \times 60^{2}$$

= 1350]

8. Calculate the Ek of a car which has a mass of 1000 kg and is moving at the rate of 20 m/s.

 $E_{L} = 0.5 \times 1000 \times 20^{2}$ = 200,000 T 9. What is the Ek of a soccer ball which has a mass of 0.8 kg and is kicked at a velocity of 10m/s?

Eu = 0.5 × 0.8 × 102 = 40J

10. Calculate the Ek of a runner that has a mass of 80 kg and is running at a velocity of 8 m/s.

EK = 0.5 × 80 × 82 = 2560J

- 11. Circle the one with **MORE** Kinetic energy and briefly explain why.
- A. A 25 kg mass or a 30 kg mass going 5 m/s.

greater mass

B. Two 10 kg masses, one going 75 m/s, one going 45 m/s.

greater velocity

C. A car at rest or a car rolling down a hill.

Rolling car is moving

12. A 4 kg rock is rolling 10 m/s. Find its kinetic energy.

Eu = 0.5 × 4 × 102 = 200T

13. A 8 kg cat is running 4 m/s. How much kinetic energy does it have?

 $E_{k}=0.5\times8\times4^{2}$ =64J

POTEUTIAL EUERGY CALCULATIOUS WHOOP WHOOP WHOOP

1. A baby carriage is sitting at the top of a hill that is 21m high. The carriage with the baby has a mass of 12kg. Calculate its GPE.

$$E_p = 12 \times 9.8 \times 21 = 2469.6$$

2. A wooden block is sitting on a platform 20m high. Its mass is 79kg. Calculate its GPE.

3. There is a bell at the top of a tower that is 45m high. The bell weighs 190kg. Calculate its GPE.

$$Ep = 190 \times 9.8 \times 45$$

= 83,7905

4. A rollercoaster cart is stationary at the top of a 72m hill and weighs 966kg. Calculate its

GPE.
$$E_p = 966 \times 9.8 \times 72$$

= $681,609.6$ J

5. The potential energy of an apple is 6 joules. The apple is 3m high. What is the mass of the

apple?
$$E_p = mgh$$

$$6 = m \times 9.8 \times 3$$

$$6 = m \times 9.8 \times 3$$

$$6 = m \times 9.8 \times 3$$

$$6 = m \times 29.4$$

$$m = 0.204kg$$

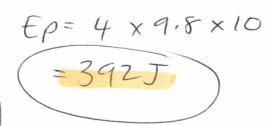
- 6. Two objects were lifted by a machine. One object had a mass of 2 kg, and was lifted at a speed of 2m/s. the other object had a mass of 4kg and was lifted at rate of 3m/s.
 - a) Which had more kinetic energy while it was being lifted?

b) Which object had more potential energy when it was lifted to a distance of 10 metres?

Show your calculation.

$$\xi \rho = 2 \times 9.8 \times 10$$

= 1965





- 7. You are on roller blades on top of a small hill. Your potential energy is equal to 1000 joules. The last time you checked your mass was 60kg.
 - a) What is the height of the hill?

$$Ep = mgh$$
 $1000 = 60 \times 9.8 \times h$
 $h = 1.7m$
 $1000 = 588 \times h$
 $\frac{1000}{588} = h$



b) If you start skating down this hill, your potential energy will be converted to kinetic energy. At the bottom of the hill, your kinetic energy will be equal to your potential energy at the top, this is the law of Conservation of energy. What will be your speed at the bottom of the hill?

NOTE:
$$PE = KE$$
 So: $PE = \frac{1}{2}mv^2$

$$1000 = 0.5 \times 60 \times v^{2}$$

$$1000 = 30 \times v^{2}$$

$$1000 = v^{2}$$

$$E_{k} = 1000 \text{ J}$$

$$\frac{1000}{30} = \sqrt{2}$$

$$\frac{1000}{30} = \sqrt{2}$$

$$33.33 = \sqrt{2}$$

$$\sqrt{2}$$

$$\sqrt{3}$$

8. i) What was the kinetic energy of a 1kg ball thrown into the air with an initial velocity of 30m/s? Include a diagram!

ii) How much potential energy does the ball have when it reaches the top of its ascent? (Think about the law of conservation PE = KE)

iii) How high into the air did the ball travel? *KE = PE

$$450 = 1 \times 9.8 \times h$$

 450
 $9.8 = h$

- h=45.2m
- 9. What is the potential energy of a 3kg ball that is on the ground?

v <u>1</u>