Mech E before = $\sum_i$ E after

Mechanical Energy and Work 2017-10-26

mech E before = sum of useful + useless E after
useless / unwanted

3 What is going to happen to some of the mechanical energy in each of the following cases?

Does this contradict the Law of Conservation of Mass? No bec the E is not "lost" (or dissipated) - it is there somewhere but not what you want !

1. Braking sharply → sound E → heat E dissipated
2. Hammering a nail → sound E → heat E dissipated
3. Cutting a piece of metal " " dissipated
4. Rubbing both hands together, vigorously → heat E dissipated
5. A shooting star entering the mesosphere → heat E dissipated → light E

5 Energy can be present in several different forms in nature.

What is the name given to the form of energy linked exclusively to the position of an object?

A) Kinetic energy
B) Potential energy
C) Mechanical energy
D) Electrical energy

6 A cyclist and her bicycle together have a mass of 80 kg. She arrives at the bottom of a hill at a speed of 10 m/s and stops pedalling. The bicycle begins to coast up the hill. → ∅ Ep

V

Disregarding friction, how high could the cyclist possibly rise up the hill? = all Ek

SKETCH AND LABEL INFO

A) 0.5 m

B) 1.0 m

C) 5.0 m

D) 10.0 m

$TME\ bottom = \cancel{Ep}^{\emptyset} + E_K$

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

$= \frac{1}{2}(80.\,kg)(10\,\frac{m}{s})^2$

$= 4000\ J$ of E_K

$TME\ top = Ep + \cancel{E_K}^{\emptyset}$ ∅ bec stop

$\frac{Ep}{mg} = \frac{mgh}{mg} = \frac{4000\ J}{(80.\,kg)(9.8\,m/s^2)} = h$

7 A car, travelling along a horizontal road, has kinetic energy of 1.6×10^6 J. $\times 0.25 = 4.0 \times 10^5$ $- E_K$

The driver slows the car to half of its original speed.

What is the new kinetic energy of the car?

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

A) 1.6×10^6 J

B) 8.0×10^5 J

C) 4.0×10^5 J

D) 1.6×10^5 J

- so let's say $v_1 = 10\ \frac{m}{s}$
- then $v_2 = 5\ \frac{m}{s}$
- let's say $m = 1$ kg

$E_{K_1} = \frac{1}{2}mv_1^2$

$E_K = \frac{1}{2}(1)(10)^2$

$= 50$ J

$E_{K_2} = \frac{1}{2}(1)(5)^2$

$= 12.5$ J

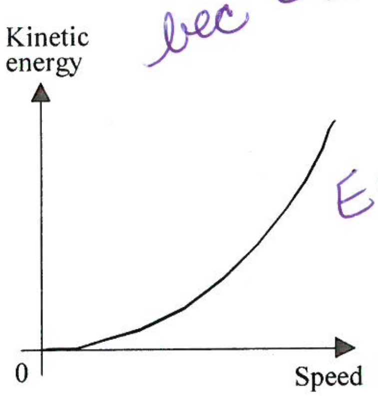
$\therefore \frac{E_{K2}}{E_{K_1}} = \frac{12.5\text{ J}}{50\text{ J}} = 0.25$ or $\frac{1}{4}$ the original

8 The kinetic energy of an object depends on several factors.

Which one of the following graphs represents the change in kinetic energy of an object as a function of its speed?

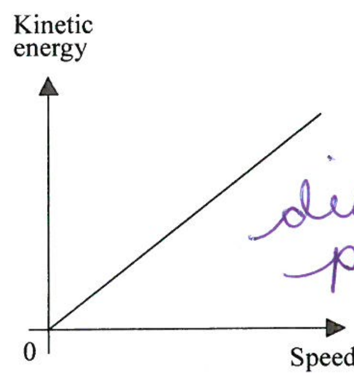
bec $E_K = \frac{1}{2}mv^2$

A)



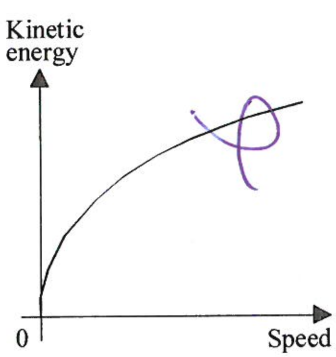
$E_K \propto v^2$ ✓

C)

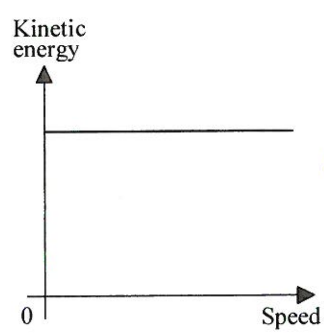


directly proportional to $E_K \propto v$ X

B)



D)



so no effect of speed on E_K

12 Which statement best describes mechanical work?

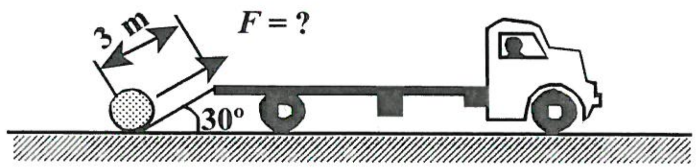
A) It is the product of the mass and its speed. mv = "momentum"

B) It is the product of the component force in the direction of the displacement and the corresponding ~~time~~ interval during which the force acts.

C) It is the product of the component force in the direction of the displacement and the displacement itself. ✓

D) It is the product of the mass and the acceleration. $F = ma$

13 A 200-kg oil barrel is moved up a ramp onto a flatbed truck at a constant speed. The ramp is 3 m long and makes an angle of 30 ° with the ground. Frictional forces are **negligible.**



What is the magnitude of the force that must be exerted parallel to the ramp?

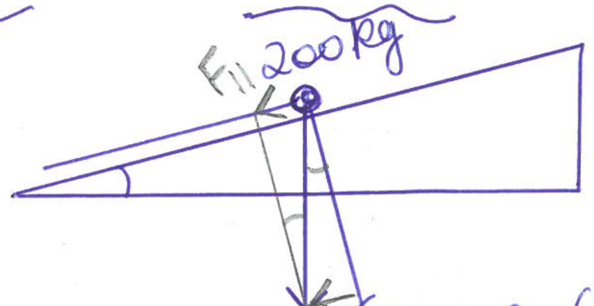
$F_{\parallel}$ = Feff on the ramp

A) 980 N

B) 1697 N

C) 1960 N

D) 2940 N



$F_{\parallel} = H \sin\theta$
$= F_g \sin\theta$
$= 1960\,N \sin 30°$

$F_g = mg = (200\,kg)(9.8\,m/s^2) = 1960\,N$

14 A machine uses a ball and a detector. A ball with a mass of 0.1 kg has to hit the detector that is 1.0 m above the surface. The mechanism is shown below.

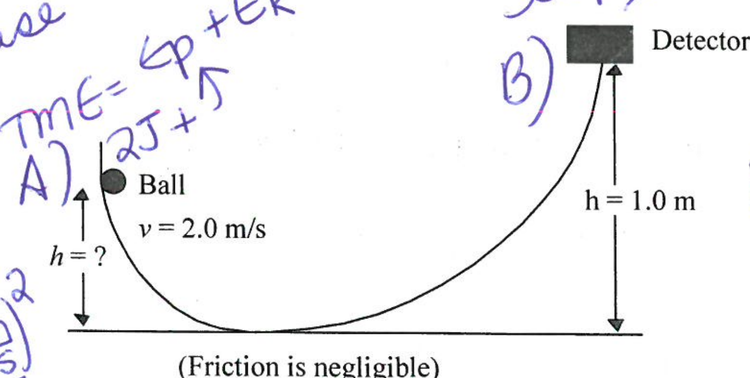
I'm going to say m = 1 kg because I can!

top all $E_p = mgh$

B) $= (1\,kg)(9.8\,\frac{m}{s^2})(1.0\,m)$

TME = $E_p + E_K$

A) 2J + ?



B) $E_p = 9.8\,J$ with Ø E_K

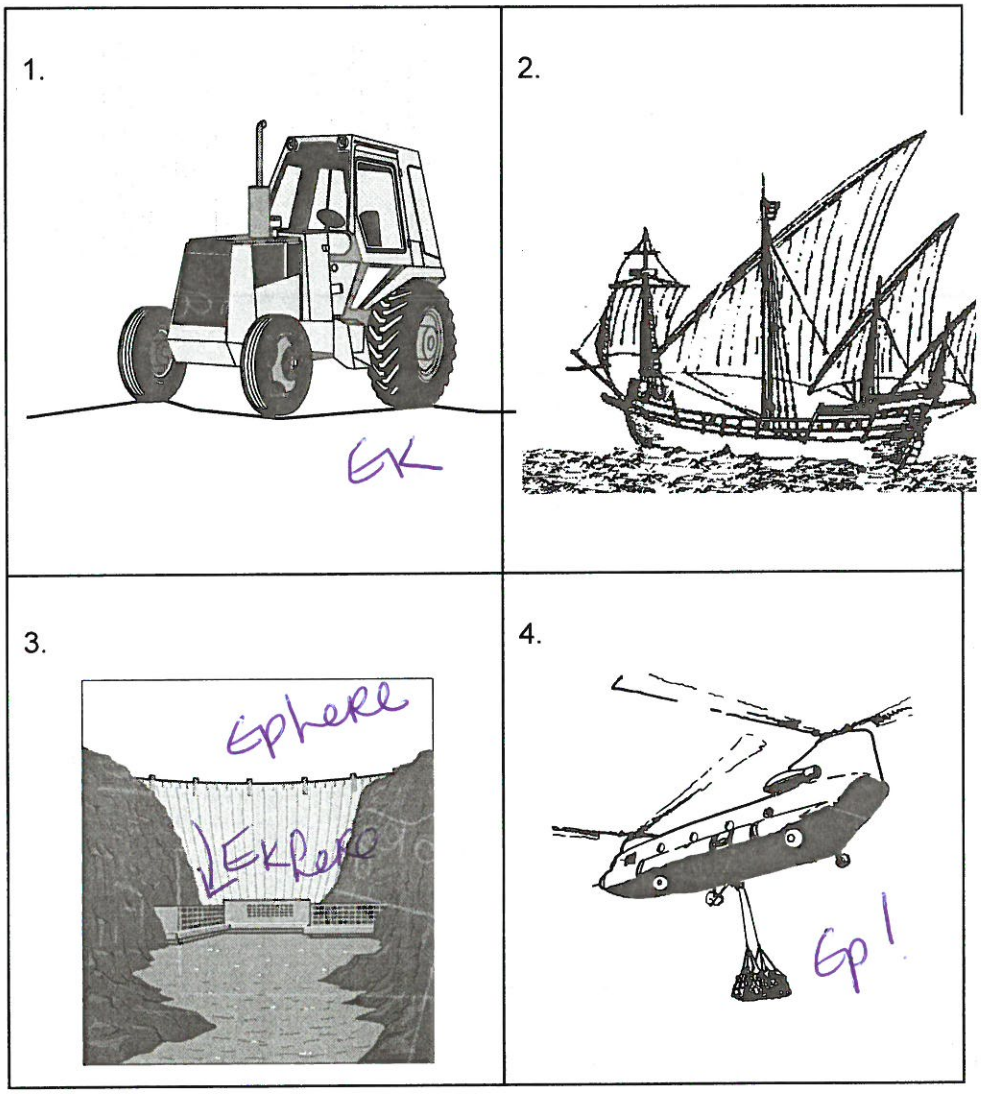
A) $E_K = \frac{1}{2}mv^2$
$= \frac{1}{2}(1\,kg)(2.0\,\frac{m}{s})^2$
$= 2J$

A) h = 0.80 m

If the ball is moving with an initial speed of 2.0 m/s, from what height must it start so that it will hit the detector?

A) $E_p = TME - E_K = 9.8\,J - 2.0\,J = 7.8\,J$ $\quad \frac{E_p}{mg} = \frac{mgh}{mg} = \frac{7.8\,J}{(1\,kg)(9.8\,m/s^2)} =$

15 Which of the following illustrate the concept of gravitational potential energy?



Ek

A) 1 and 2

B) 1 and 3

C) 2 and 4

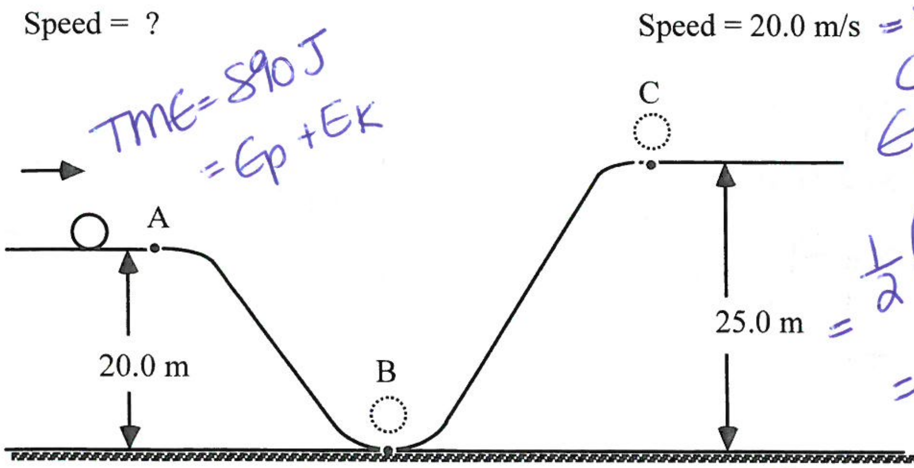
D) 3 and 4

$-m$

22 A 2.0 kg ball rolls along a frictionless surface, as illustrated below. It passes point C at a speed of 20.0 m/s.

$V =$

$(25.0\,m)$



$= V_C$

$TME = 890\,J$
$= E_p + E_K$

C) $E_K + E_p = TME$

$\frac{1}{2}(2.0\,kg)(20.0\,\frac{m}{s})^2 + (2.0\,kg)(9.8\,\frac{m}{s^2})$

$= 400\,J + 490\,J$
$= 890\,J = TME$

E_p at A) $= mgh = (2.0\,kg)(9.8\,m/s^2)(20.0\,m) = 392\,J$

What was the speed of the ball at point A?

$TME = \cancel{E_p} + E_K - \cancel{E_p}$
$-E_p$ $\quad 890\,J - 392\,J = E_K = 498\,J$

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

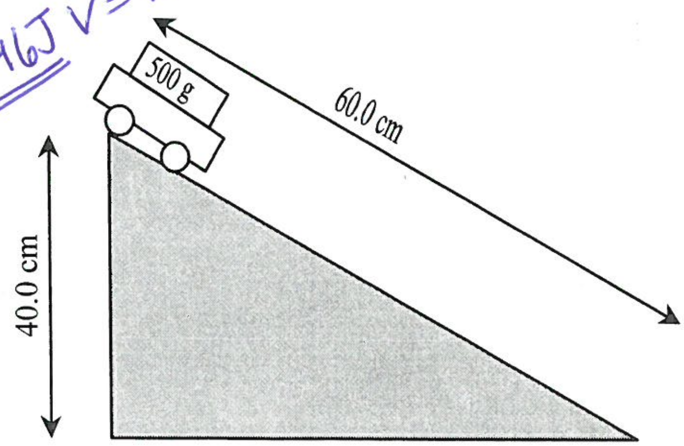
$V = \sqrt{\frac{2E_K}{m}}$

$= \sqrt{\frac{2(498\,J)}{2.0\,kg}}$

$V = 22\,\frac{m}{s}$ at A

23 A cart, which is initially at rest, moves down an inclined plane. The effects of friction are negligible. The mass of the cart is 500 g, the incline is 40.0 cm high and 60.0 cm long.

E_P $1.96\,J$ $\quad V = \emptyset$



$-20.0\,cm$

What is the speed of the cart when it has gone half way down the incline?

A) 1.98 m/s
B) 2.80 m/s
C) 3.92 m/s
D) 19.8 m/s

I) all $E_p = mgh$ at top

$= (0.5\,kg)(9.8\,\frac{m}{s^2})(0.4\,m)$
$= 1.96\,J \times 0.5 =$
$= 0.98\,J$ halfway down

II) $V = \sqrt{\frac{2E_K}{m}}$

$= \sqrt{\frac{2(0.98\,J)}{0.5\,kg}} = 1.98\,m/s$