Name: _____

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Work and Energy In Class Review

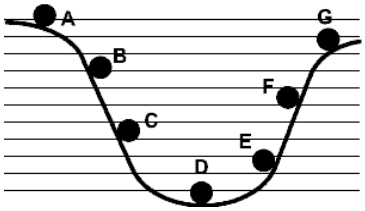
1. Work	A. Rate of doing work; how fast you transfer energy.
2. Power	B. Energy of position or height.
3. Kinetic Energy	C. Applied energy; can create energy.
4. Potential Energy	D. Energy of something that can be compressed.
5. Potential Elastic Energy	E. Energy due to motion and inertia.

6. Law of Conservation of Energy	A. How fast something is done.
7. Rate	B. An object that moves forever without added energy.
8. Work-Kinetic Energy Theorem	C. A change in kinetic energy comes from work.
9. Energy	D. Energy can be transformed, but not created nor destroyed.
10. Perpetual motion	E. Stored work; ability to create forces or cause motion.

11. Chemical	A. Energy stored in the atom.
12. Nuclear	B. Energy stored in molecular bonds.
13. Mechanical	C. Caused by friction. Heat.
14. Thermal	D. Due to moving electrons.
15. Electrical	E. From light.
16. Radiant	F. Any kinetic or potential energy.

17. Which of the following shows positions from highest to lowest kinetic energy?

i. E, G, F
ii. E, F, A
iii. A, F, D



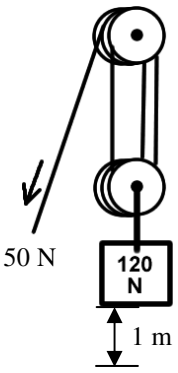
18. A person pulls down with 50 N to lift an object 1 m.

A) Since there are three support ropes, how much rope is pulled out by the 50N force?

B) What is W_{in}?

C) What is W_{out}?

D) Calculate efficiency.



E) How much energy was lost?
F) Where did it go?

G) If the pulley was 100% efficient, how much force would you have needed?

19. A more powerful motor does more work. True or false?

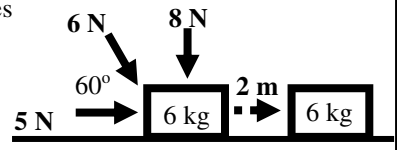
20. In the same amount of time a more powerful motor:

21. How much energy does a 60 W light bulb use in 2 minutes? (*Be sure to use seconds.*)

22. A 70 kg person climbs up 2 meters in 2.8 seconds.
A) How much E_p did they gain?

B) How much power did they use?

23. A. Which of the 3 forces does no work on the object?
B. Find the *total work* done on the 6 kg mass.



C. If there is no friction, how much energy does it gain?

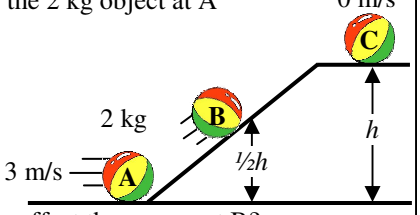
24. You hold onto a book for an hour.
A. Does your body get tired?
B. Does your body use energy?
C. Do you do any work on the object?
D. Why?

25. $E_k = E_p$	A. A spring shoots an object.
26. $W = PE_{el}$	B. An object is lifted up.
27. $E_k - W = 0$	C. A moving object is stopped.
28. $E_p - W = Ek$	D. An object drops. There is friction.
29. $W = Ep$	E. A force compresses a spring.
30. $PE_{el} = Ek$	F. A moving object goes up a ramp.

31. A. Find the energy of the 2 kg object at A

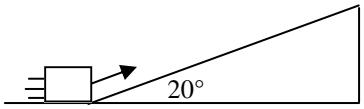
B. E_p at C =

C. E_k at B =



F. How would friction affect the energy at B?

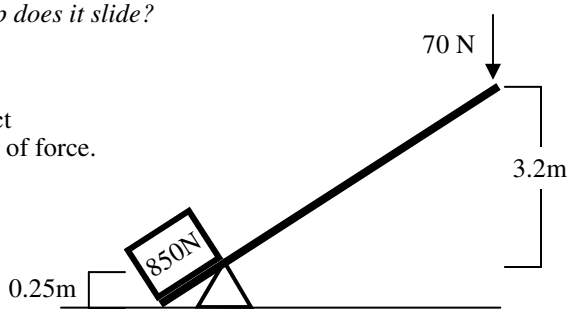
32. Can a simple machine ever have an efficiency greater than 100%? Why or why not?



33. A frictionless ramp is inclined at 20°. An object going 6 m/s slides up.
    A) Find the final height of the object.

    B) *How far up the ramp does it slide?*

34. A person pushes down on a lever 3.2 meters to lift a 850 N object 0.25 meters up. The person pushes down on the lever with 70 N of force.
    A. W_{in} =
    B. W_{out} =
    C. Calculate the efficiency of the lever.



35. A 1.2 kg rock is dropped from 20 meters. The rock is going only 15 m/s just before it hits the ground because of air friction.
    A) How far does friction act on the rock?
    B) How far does the rock drop?
    C) Does all of the Ep turn into Ek?
    D) Does friction add or subtract energy?
    E) Find the force of air friction on the rock.

36. A 6 kg object going 2 m/s speeds up to 7 m/s due to a 4 N force.
    A) How many meters does the force act?

    B) What is the acceleration of the object?

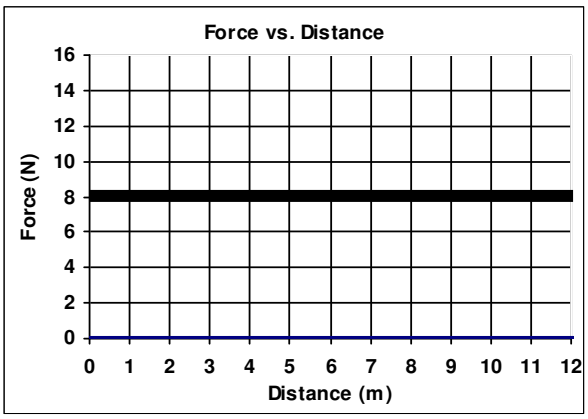
37. A 4 kg mass going 6 m/s stops by compressing a spring 1.3 meters. Find the spring constant of the spring. (VEO)
    (*VEO—variables and equation only. Give equations, put in numbers, and do not solve.)*

38. A 5 kg object is dropped from 30 meters up. How fast is it going 10 meters above the ground? (VEO)

39. A 3 kg object is originally at rest is pushed on by the force shown on the graph at the right.

    A) Find the work done on the object in the first 10 m.

    B) Find the final velocity of the object.



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5. Potential Elastic Energy D	E. Energy due to motion and inertia.

6. Law of Conservation of Energy D	A. How fast something is done.
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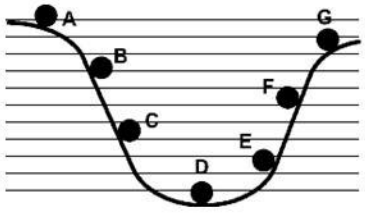


18. A person pulls down with 50 N to lift an object 1 m.

A) Since there are three support ropes, how much rope is pulled out by the 50N force? 3m (1m for each rope)

B) What is W_{in}? $W = 50(3) = 150$ J

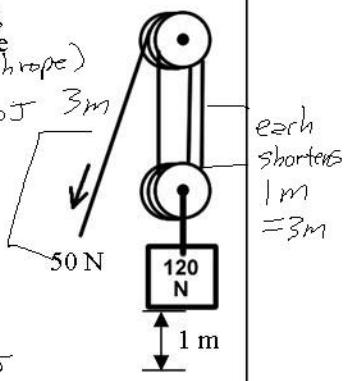
C) What is W_{out}? $E_p = 12(10)(1) = 120$ J

D) Calculate efficiency. $\frac{120}{150} = 80\%$

E) How much energy was lost? 30J

F) Where did it go? friction

G) If the pulley was 100% efficient, how much force would you have needed? $120/3 = 40$ N



19. A more powerful motor does more work. True or false?

just does it faster.

20. In the same amount of time a more powerful motor:

does more work.

21. How much energy (work) does a 60 W light bulb use in 2 minutes? (*Be sure to use seconds.*)

$P = \frac{W}{t}$ $\quad 60 = \frac{W}{120}$ $\quad 120(60) = W$ $\quad 7200\text{ J} = W$

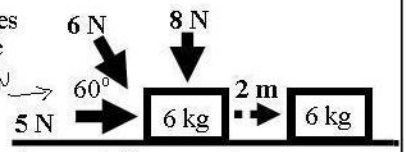
22. A 70 kg person climbs up 2 meters in 2.8 seconds.

A) How much E_p did they gain? $E_p = mgh = 70(10)(2) = 1400$ J

B) How much power did they use? $P = \frac{W}{t} = \frac{1400}{2.8} = 500$ W

23. A. Which of the 3 forces does no work on the object? 8 N

B. Find the *total work* done on the 6 kg mass. $6\cos 60° = 3$ N



$W = Fd = (5+3)2 = 8(2) = 16$ J

C. If there is no friction, how much energy does it gain?

16 J

24. You hold onto a book for an hour.

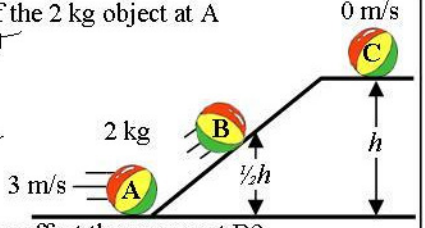
A. Does your body get tired? yes
B. Does your body use energy? yes
C. Do you do any work on the object? No
D. Why? Book does move or change E.

25. $E_k = E_p$ F	A. A spring shoots an object.
26. $W = PE_{el}$ E	B. An object is lifted up.
27. $E_k - W = 0$ C	C. A moving object is stopped.
28. $E_p - W = Ek$ D	D. An object drops. There is friction.
29. $W = Ep$ B	E. A force compresses a spring.
30. $PE_{el} = Ek$ A	F. A moving object goes up a ramp.

31. A. Find the energy of the 2 kg object at A $\frac{1}{2}(2)3^2 = 9$ J

B. E_p at C = 9 J

C. E_k at B = 4.5 J



F. How would friction affect the energy at B?

less E_k (total E decr.)

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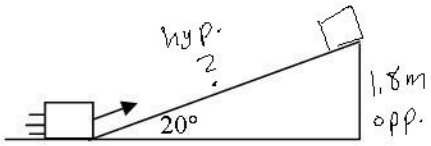
32. Can a simple machine ever have an efficiency greater than 100%? Why or why not?

Against Law of Conservation of Energy. Means getting more E out than you put in.



33. A frictionless ramp is inclined at 20°. An object going 6 m/s slides up.
A) Find the final height of the object.

$E_k = E_p$ → $\frac{1}{2}mv^2 = mgh$ → $\frac{1}{2}(6^2) = 10h$ → $\frac{1}{2}(36) = 10h$ → $18 = 10h$ → $h = 1.8\,m$

Note: Since you are looking for height (which is vertical) you don't care about the ramp's angle. Ep will give you h.

B) *How far up the ramp does it roll?*

"how far up ramp" is the hypo. h is opp. the angle, so use sin.

$\sin 20° = \frac{opp}{hyp.}$ → $.342 = \frac{1.8}{H}$ → $.342H = 1.8$ → $H = \frac{1.8}{.342} = 5.26\,m$

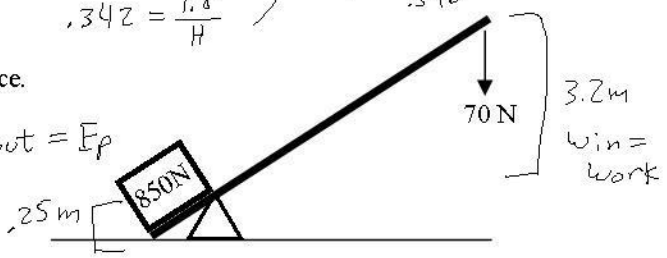
34. A person pushes down on a lever 3.2 meters to lift a 850 N object 0.25 meters up. The person pushes down on the lever with 70 N of force. Find the efficiency of the lever.

You put in work to get out Ep. So, Win = Fd and Wout = mgh Remember that m = 85 kg OR realize that mg = the weight of the object, which = 850 N.

$W_{in} = Fd = 70(3.2) = 224\,J$

$W_{out} = E_p = mgh = 850(.25) = 212.5\,J$

$E_{ff} = \frac{W_{out}}{W_{in}} = \frac{212.5}{224} = 95\%$



35. A 1.2 kg rock is dropped from 20 meters. The rock is going only 15 m/s just before it hits the ground because of air friction.
A) How far does friction act on the rock? 20m
B) How far does the rock drop? 20m
C) Does all of the Ep turn into Ek? No (friction)
D) Does friction add or subtract energy?
E) Find the force of air friction on the rock.

For dropped objects the height for Ep (h) is the same as the distance for friction (W = Fd). So h = d = 20 m

$E_p - W = E_k$

$mgh - Fd = \frac{1}{2}mv^2$

m's don't cancel

$1.2(10)(20) - F(20) = \frac{1}{2}(1.2)(15)^2$

$240 - 20F = 135$

$240 = 135 + 20F$

$240 - 135 = 20F$

$105 = 20F$

$5.25\,N = F$

↑ notice: less E_k than E_p due to friction

36. A 6 kg object going 2 m/s speeds up to 7 m/s due to a 4 N force.
A) How many meters does the force act?

$E_k + W = E_k$

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

$\frac{1}{2}(6)2^2 + 4(d) = \frac{1}{2}(6)7^2$

$3(4) + 4d = 3(49)$

$12 + 4d = 147$

$4d = 147 - 12 = 135$

$d = 135/4 = 33.75\,m$

B) What is the acceleration of the object?

$F = ma$

$4 = 6a$ → $a = 4/6 = .67\,m/s^2$

(or could have used a kinematic eq.)

37. A 4 kg mass going 6 m/s stops by compressing a spring 1.3 meters. Find the spring constant of the spring. (VEO)
(VEO—variables and equation only. Give equations, put in numbers, and do not solve.)

$E_k = PE_{el}$

$\frac{1}{2}mv^2 = \frac{1}{2}kx^2$ → $\frac{1}{2}4(6^2) = \frac{1}{2}k(1.3)^2$

stop (VEO)

This is all you need if I write VEO.

solution (for the curious)

½'s cancel

$4(6^2) = k(1.3^2)$

$144 = k(1.69)$

$k = 144/1.69 = 85.2\,N/m$

38. A 5 kg object is dropped from 30 meters up. How fast is it going 10 meters above the ground? (VEO)

$E_p = E_p + E_k$

10 m above the ground it has Ep and since it's moving it also has Ek.

$mgh_b = mgh_A + \frac{1}{2}mv^2$

$5(10)30 = 5(10)10 + \frac{1}{2}(5)v^2$

DONE: VEO

solution: m's cancel

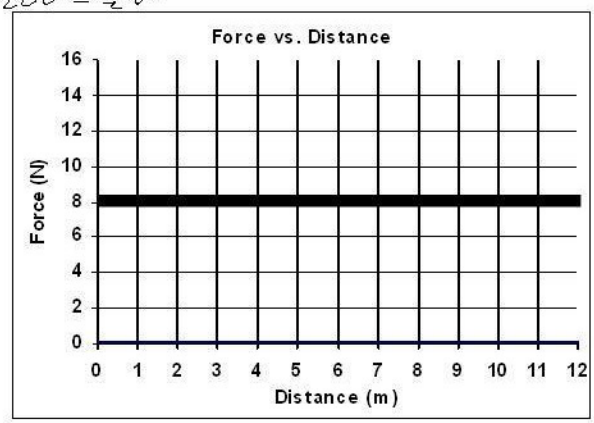
$300 = 100 + \frac{1}{2}v^2$

$200 = \frac{1}{2}v^2$

$400 = v^2$

$20\,m/s = v$

39. A 3 kg object is originally at rest is pushed on by the force shown on the graph at the right.



A) Find the work done on the object in the first 10 m.

$W = Fd$

$W = 8(10) = 80\,J$

B) Find the final velocity of the object.

$0 + W = E_k$

$80 = \frac{1}{2}(3)v^2$

$160 = 3v^2$

$53.3 = v^2$

$v = 7.3\,m/s$