Name KEY

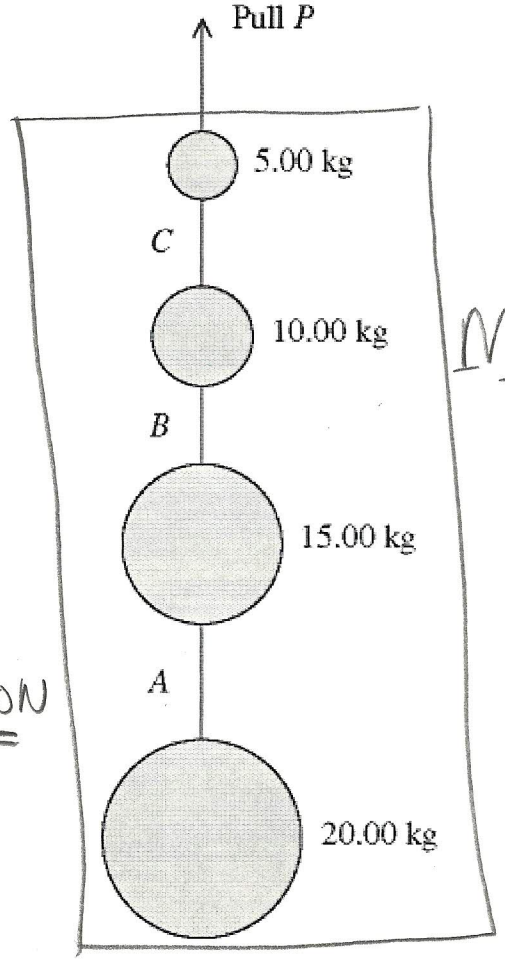
Exam 2 ~~23~~ questions → 22 scored

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) At the bottom of this page there is a capital letter in front of the page number. What is that letter?

A) A NOT SCORED B) B NOT SCORED C) C

2) A series of weights connected by very light cords are given an upward acceleration of 4.00 m/s^2 by a pull *P*, as shown in the figure. *A*, *B*, and *C* are the tensions in the connecting cords. The pull *P* is closest to



for M: $\vec{P} = P\hat{j}$, $\vec{F}_g = -Mg\hat{j}$

2nd: $\hat{j}\ \Sigma F_y = Ma_y$

$P - Mg = Ma_y$

$\therefore P = Mg + Ma_y = 690\,N$

$M = 20 + 15 + 10 + 5 = 50\,kg$

A) 200 N. B) 290 N. C) 50 N. D) 490 N. E) 690 N.

3) A 20-ton truck collides with a 1500-lb car and causes a lot of damage to the car. During the collision _____.

A) the force on the car due to the collision is much greater than the force on the truck.

B) the force on the truck due to the collision is slightly greater than the force on the car.

C) the force of on the truck due to the collision is exactly equal to the force on the car. ✓ 3rd law

D) the car and the truck have the same magnitude acceleration.

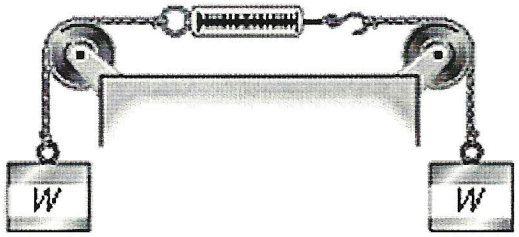
Constant $\vec{F}$

$W = \vec{F} \cdot \vec{D} = (.4)(80)(9.8)(4) = 1254\,J$

4) A student slides her 80.0-kg desk across the level floor of her dormitory room a distance 4.00 m at constant speed. If the coefficient of kinetic friction between the desk and the floor is 0.400, how much work did she do?

A) 128 J B) 24.0 J C) 26.7 J D) 3.14 kJ (E) 1.26 kJ

5) Two objects, each of weight *W*, hang as shown in the figure. The pulleys, the scale, and the strings attached to the objects have negligible weight, and there is no friction in the pulleys. The reading of the scale is ____.



$\Sigma F_y = ma_y$

$T - mg = 0$

$T = mg$

$\vec{F}_g = -mg\hat{j}$

A) less than *W*.

B) more than 2*W*.

C) 2*W*.

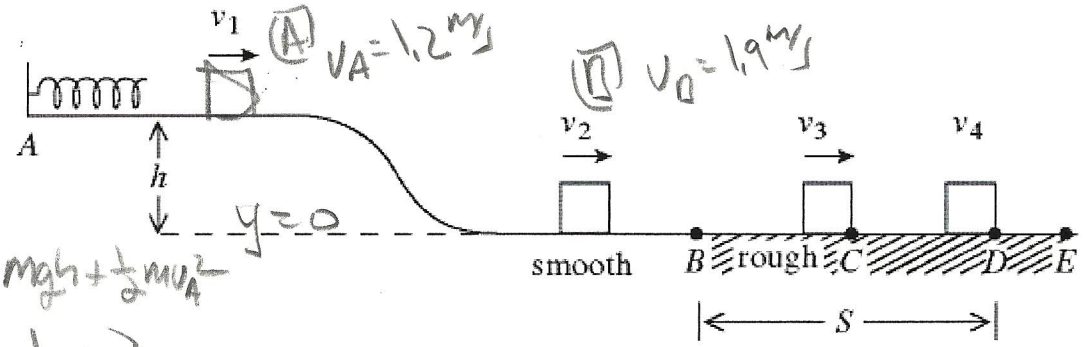
(D) *W*.

E) more than *W*, but not quite twice as much.

Same diagram!

= Even if weights were different, T would be the same for each, a would not be zero.

6) A 1.86-kg block is held in place against the spring by a 81-N horizontal external force (see the figure). The external force is removed, and the block is projected with a velocity v_1 = 1.2 m/s upon separation from the spring. The block descends a ramp and has a velocity v_2 = 1.9 m/s at the bottom. The track is frictionless between points *A* and *B*. The block enters a rough section at B, extending to *E*. The coefficient of kinetic friction over this section is 0.28. The velocity of the block is v_3 = 1.4 m/s at *C*. The block moves on to *D*, where it stops. The height *h* of the ramp is closest to _____.



(A) $v_A = 1.2\,m/s$

(B) $v_B = 1.9\,m/s$

$TE_A = mgh + \frac{1}{2}mv_A^2$

$TE_B = \frac{1}{2}mv_B^2$

A) 15 cm B) 17 cm (C) 11 cm D) 18 cm E) 7.3 cm

Cons. of Energy $\Rightarrow$ $TE_A = TE_B$

$mgh + \frac{1}{2}mv_A^2 = \frac{1}{2}mv_B^2$

$h = \frac{1}{2}(v_B^2 - v_A^2)/g = 0.11$ meters

7) A girl throws a stone from a bridge. Consider the following ways she might throw the stone. The speed of the stone as it leaves her hand is the same in each case, and air resistance is negligible.

Case A: Thrown straight up.
Case B: Thrown straight down.
Case C: Thrown out at an angle of 45° above horizontal.
Case D: Thrown straight out horizontally.

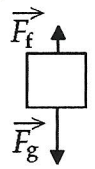
In which case will the speed of the stone be greatest when ~~it hits~~ the water below?

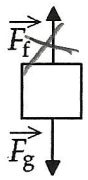
A) Case A
B) Case B
C) Case C
D) Case D
E) The speed will be the same in all cases.

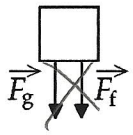
8) A ball drops some distance and gains 30 J of kinetic energy. Do NOT ignore air resistance. How much gravitational potential energy did the ball lose?

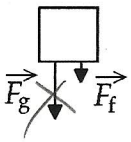
A) less than 30 J B) exactly 30 J C) more than 30 J

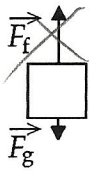
9) A person in an elevator is traveling upward, from the first floor to the fourth floor, but is gradually slowing down as the elevator approaches the fourth floor. Which one of the following free-body diagrams is correct? $\vec{F}_f$ is the force of the elevator floor on the person and $\vec{F}_g$ is the force of gravity on the person. NOTE that the length of the arrows gives you an indication of the relative size of the forces.

A) 

B) 

C) 

D) 

E) 

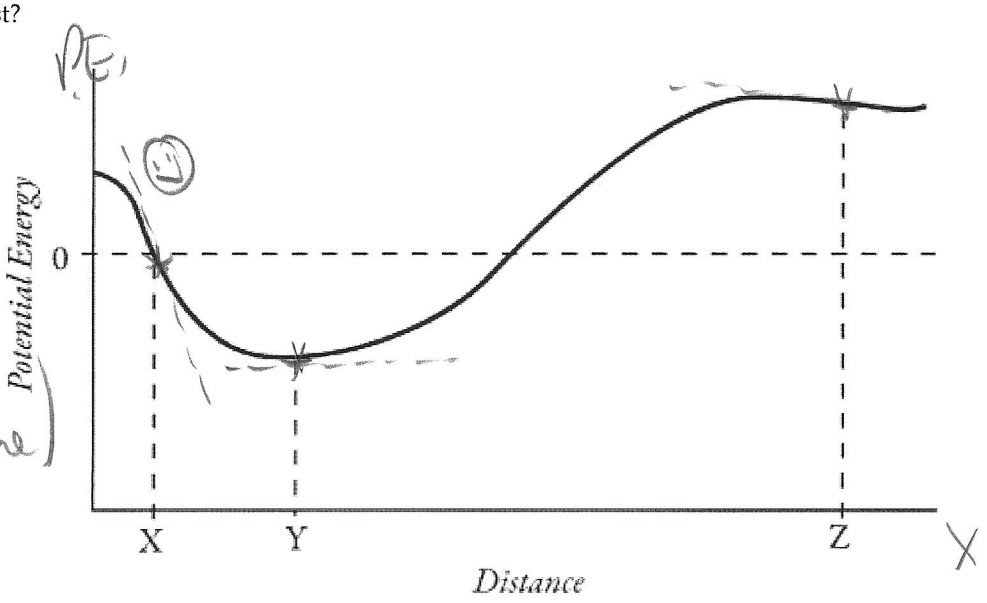
10) A stalled car is being pushed up a hill at constant velocity by three people. The net force on the car is _____.

A) up the hill and greater than the weight of the car.
B) zero.
C) down the hill and greater than the weight of the car.
D) down the hill and equal to the weight of the car.
E) up the hill and equal to the weight of the car.

11) Is it possible for a system to have negative potential energy?

A) Yes, as long as the total energy is positive.
B) Yes, since the choice of the zero of potential energy is arbitrary.
C) No, because this would have no physical meaning.
D) Yes, as long as the kinetic energy is positive.
E) No, because the kinetic energy of a system must equal its potential energy.

12) The plot in the figure shows the potential energy of a particle, due to the force exerted on it by another particle, as a function of distance. At which of the three points labeled in the figure is the magnitude of the force on the particle greatest?



1-d

$F = -\frac{d(PE)}{dx}$

-(slope of tangent line)

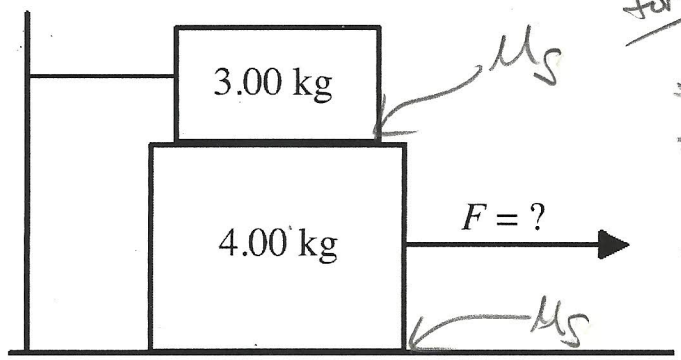
A) point X B) point Y C) point Z

13) A force $F = bx^3$ acts in the x direction, where the value of b is 3.7 N/m^3. How much work is done by this force in moving an object from $x = 0.00$ m to $x = 2.6$ m?

A) 50 J B) 57 J C) 13 J D) 42 J

$W = \int \vec{F} \cdot d\vec{s} = \int_0^{2.6} bx^3 dx = b\frac{x^4}{4}\Big|_0^{2.6} = 42\text{ J}$

14) A 4.00-kg block rests between the floor and a 3.00-kg block as shown in the figure. The 3.00-kg block is tied to a wall by a horizontal rope. If the coefficient of static friction is 0.800 between each pair of surfaces in contact, what horizontal force F must be applied to the 4.00-kg block to make it move?



for 3kg: $\vec{N}_1$, $\vec{T}_1$, f_1, $\hat{i}$, $\hat{j}$

2^{nd}: $\sum \vec{F} = 3\vec{a} = 0$

$\hat{j} \Rightarrow N = 3g$

$\therefore f_1 = 3\mu_s g$

for 4kg: $\vec{N}_2$, $\vec{F}$, f_1, f_2, $\vec{N}_1$, $F_{g_{4kg}}$

2^{nd}: $\hat{j} \Rightarrow N_2 = N_1 + 4g$

$\hat{i} \Rightarrow F = f_1 + f_2$

$F = 3\mu_s g + \mu_s(N_1 + 4g)$

$F = 10\mu_s g$

$F = 78.4$

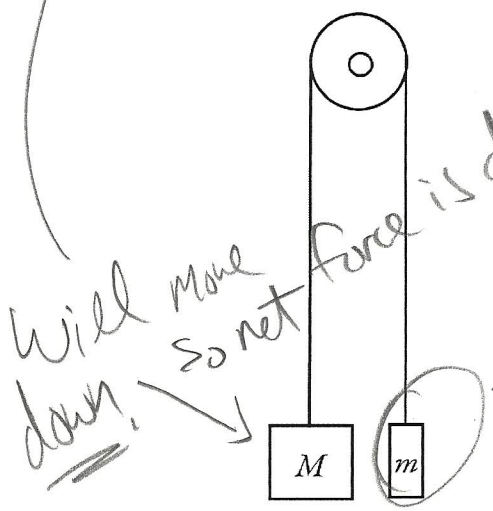
A) 78.4 N B) 21.1 N C) 16.2 N D) 23.5 N E) 54.9 N

15) An object is moving to the right, and experiencing a net force that is directed to the right. The magnitude of the force is decreasing with time. The speed of the object is _____.

A) constant in time. B) increasing. C) decreasing.

↳ but still in same direction as velocity.

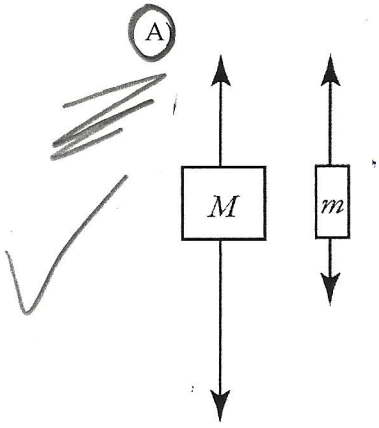
16) Two unequal masses M and m ($M > m$) are connected by a light cord passing over a pulley of negligible mass, as shown in the figure. When released, the system accelerates. Friction is negligible. Which figure below gives the correct free-body diagrams for the two masses in the moving system? NOTE that the length of the arrow is an indication of the relative size of the forces.



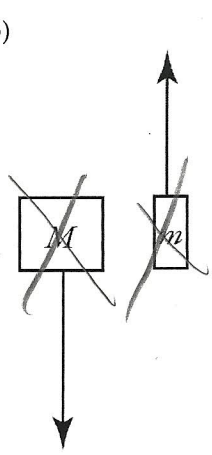
Will move down! So net force is down

Will move up, so net force is up.

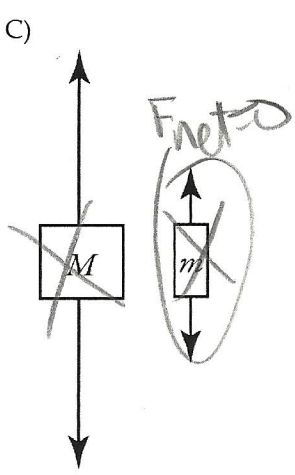
A)



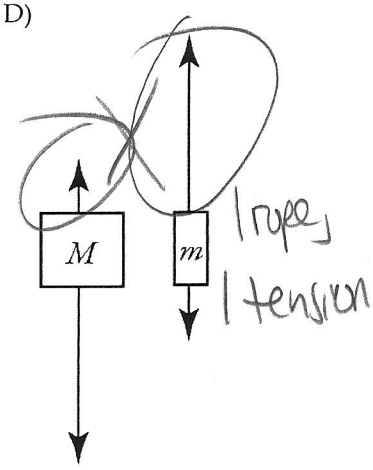
B)



C)



D)



17) Two objects, one of mass m and the other of mass $2m$, are dropped from the top of a building. When they hit the ground _____.

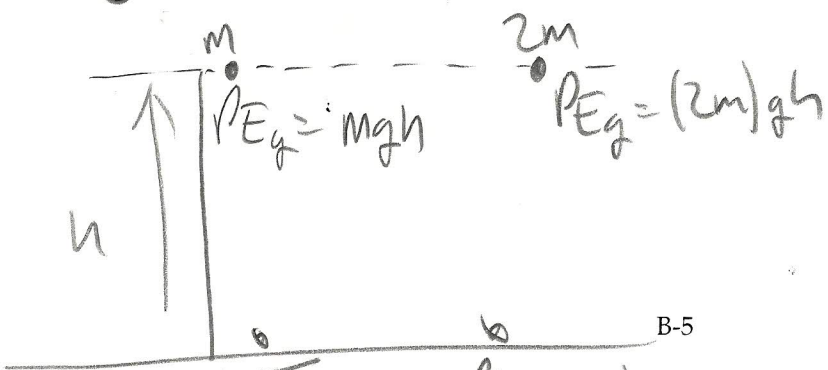
$v_0 = 0$

A) both of them will have the same kinetic energy.

B) the heavier one will have four times the kinetic energy of the lighter one.

C) the heavier one will have $\sqrt{2}$ times the kinetic energy of the lighter one.

D) the heavier one will have twice the kinetic energy of the lighter one.



OVER

Twice PE @ top means Twice KE @ bottom.

Safe to assume that wall does not move

18) Two men, Joel and Jerry, push against a concrete wall that is 3 meters thick. Jerry stops after 10 min, while Joel is able to push for 5.0 min longer. How does the work that Joel does on the wall compare to the work that Jerry does on the wall?

A) Both men do positive work, but Jerry does 50% more work than Joel.

B) Both men do positive work, but Joel does 25% more work than Jerry.

C) Both men do positive work, but Joel does 50% more work than Jerry.

D) Both men do positive work, but Joel does 75% more work than Jerry.

E) Neither of them does any work. No displacement.

19) An object is moving forward with a constant velocity. Which statement about this object MUST be true?

A) The acceleration of the object is in the forward direction. X

B) The net force on the object is zero. ✓

C) No forces are acting on the object. $\Sigma \vec{F} = 0$, could still have forces.

D) The net force on the object is in the forward direction. ZERO

20) You are standing in a moving bus, facing forward, and you suddenly fall forward as the bus comes to an immediate stop. The force acting on you that causes you to fall forward is _____.

A) the force of gravity.

B) the normal force due to your contact with the floor of the bus.

C) the force due to static friction between you and the floor of the bus.

D) the force due to kinetic friction between you and the floor of the bus.

E) No forces were acting on you to cause you to fall. 1st law

$W_{fric_1} = \vec{f} \cdot \vec{D}_1 \equiv \Delta KE_1$ (1)

$W_{fric_2} = \vec{f} \cdot \vec{D}_2 = \Delta KE_2$ (2)

$\frac{(1)}{(2)} \Rightarrow \frac{D_1}{D_2} = \frac{v_1^2}{v_2^2}$

21) A car moving at 50 km/hr skids 20 m with locked brakes. How far will the car skid with locked brakes if it were traveling at 150 km/hr?

$\therefore D_2 = \frac{v_2^2}{v_1^2} D_1 = 180$ meters

A) 20 m B) 180 m C) 60 m D) 90 m E) 120 m

Units do not matter. An 'A' question??

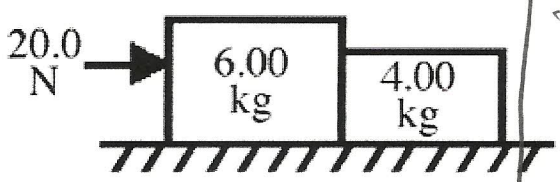
22) A block slides down a frictionless inclined ramp. If the ramp angle is 17.0° and its length is 30.0 m, find the speed of the block as it reaches the bottom of the ramp, assuming it started sliding from rest at the top.

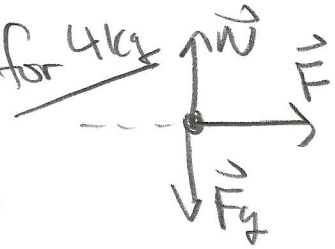
A) 13.1 m/s ✓ B) 24.0 m/s C) 9.26 m/s D) 172 m/s

$TE_{Top} = TE_{Bottom}$. Taking $y=0$ @ bottom we have $mg\,30\sin(17) = \frac{1}{2} m v_{bottom}^2$

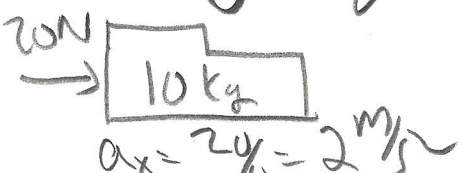
23) A 6.00-kg block is in contact with a 4.00-kg block on a horizontal frictionless surface as shown in the figure. The 6.00-kg block is being pushed by a horizontal 20.0-N force as shown. What is the magnitude of the force that the 6.00-kg block exerts on the 4.00-kg block?

Free body diagrams for each block, or take short cut to find a_x.





A) 8.00 N ✓ B) 20.0 N C) 10.0 N D) 6.00 N E) 4.00 N



$a_x = \frac{20}{10} = 2\ m/s^2$

(1) $\Sigma F_x = 4a_x$

$\therefore F = 4(2) = 8N$