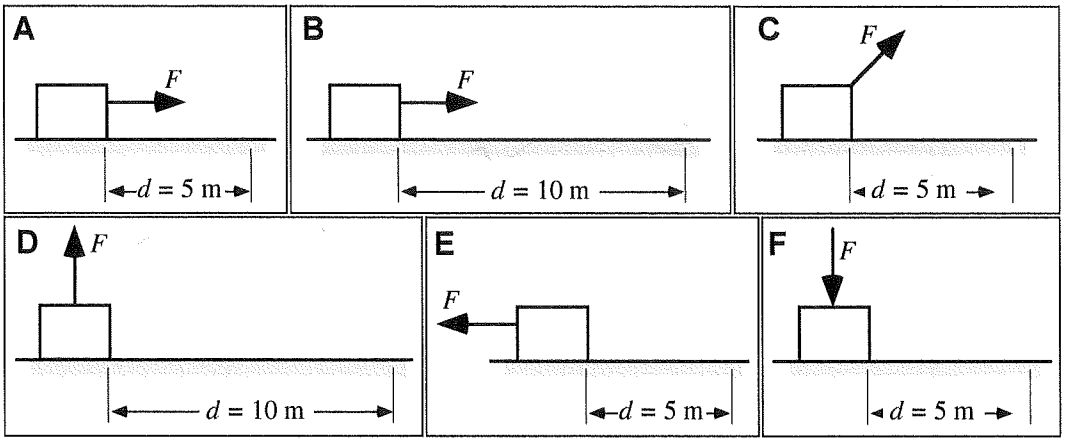
18-19 Ch 10 Energy & 11 Work TIPERS

B4-RT08: EQUAL FORCES ON BOXES—WORK DONE ON BOX

In the figures below, identical boxes of mass 10 kg are moving at the same initial velocity to the right on a flat surface. The same magnitude force, F, is applied to each box for the distance, d, indicated in the figures.



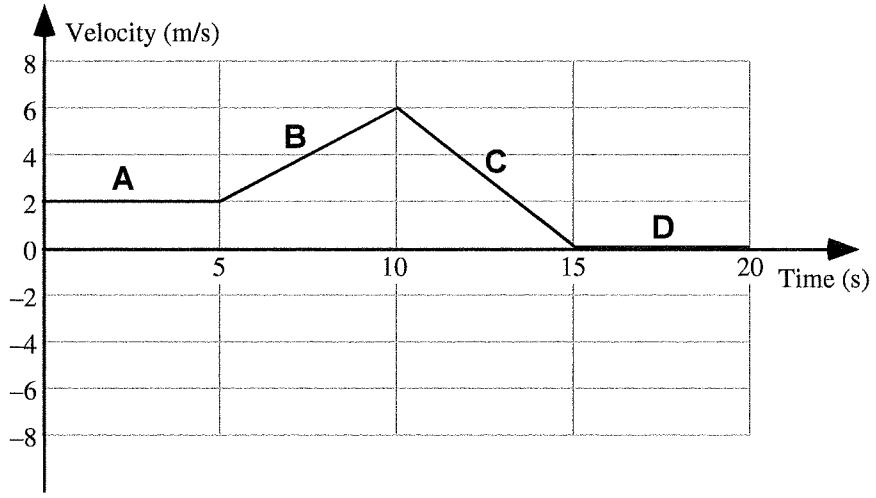
Rank the work done on the box by F while the box moves the indicated distance.

						OR			
1	2	3	4	5	6		All	All	Cannot
Greatest					Least		the same	zero	determine

Explain your reasoning.

B4-RT09: Velocity-Time Graph I—Work Done on Box

Shown below is a graph of velocity versus time for an object that moves along a straight, horizontal line under the perhaps intermittent action of a single force exerted by an external agent.



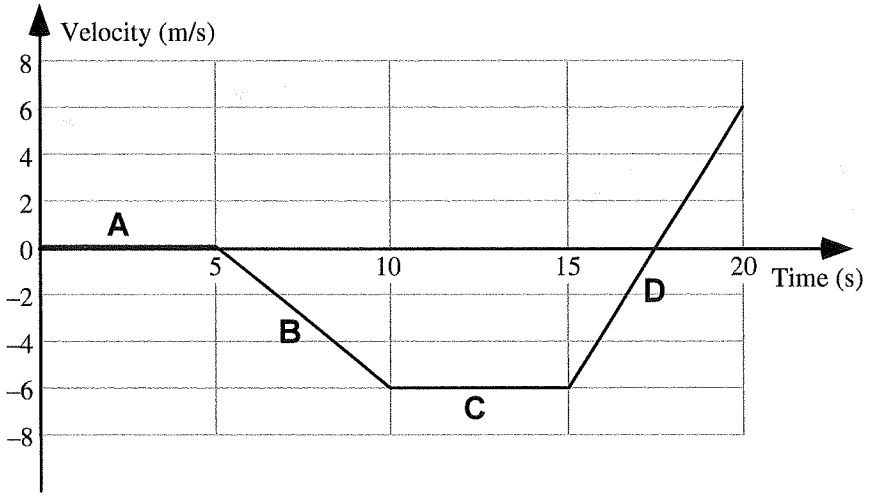
Rank the work done on the box by the external agent for the 5-second intervals shown on the graph.

				OR			
1 Greatest	2	3	4 Least		All the same	All zero	Cannot determine

Explain your reasoning.

B4-RT10: VELOCITY-TIME GRAPH II—WORK DONE ON BOX

Shown below is a graph of velocity versus time for an object that moves along a straight, horizontal line under the perhaps intermittent action of a single force exerted by an external agent.



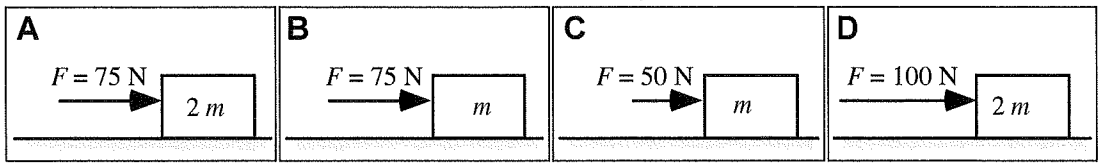
Rank the work done on the box by the external agent for the 5-second intervals shown on the graph.

				OR			
1	2	3	4		All	All	Cannot
Greatest			Least		the same	zero	determine

Explain your reasoning.

B4-RT11: FORCE PUSHING BOX—CHANGE IN KINETIC ENERGY

A box is pushed 10 m across a floor in each case shown. All boxes have an initial velocity of 10 m/s to the right. The mass of the box and the net horizontal force for each case are given.



Rank the change in kinetic energy of the boxes.

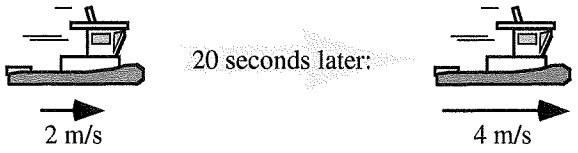
				OR			
1	2	3	4		All	All	Cannot
Greatest			Least		the same	zero	determine

Explain your reasoning.

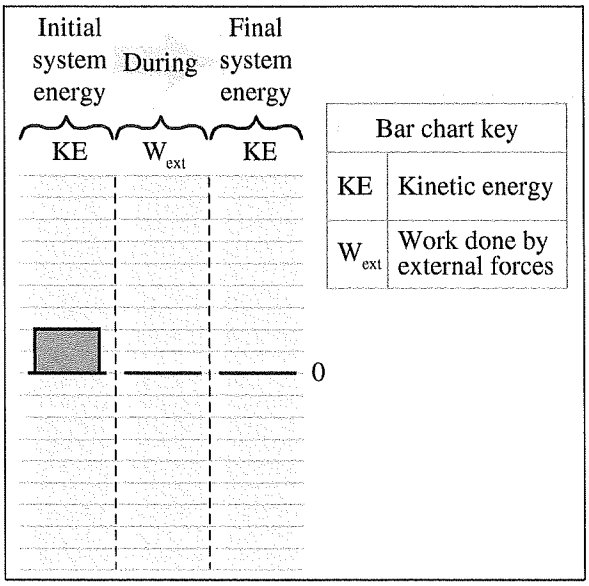
B4-BCT14: TUGBOAT CHANGING VELOCITY I—WORK & KINETIC ENERGY BAR CHART

(a) The velocity of a tugboat increases from 2 m/s to 4 m/s in the same direction while a force is applied to the tugboat for 20 seconds.

Complete the work and kinetic energy bar chart for this process. The bar heights should be in correct proportion to one another.

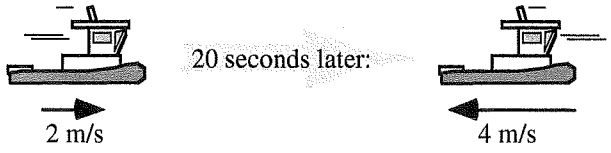


Explain.

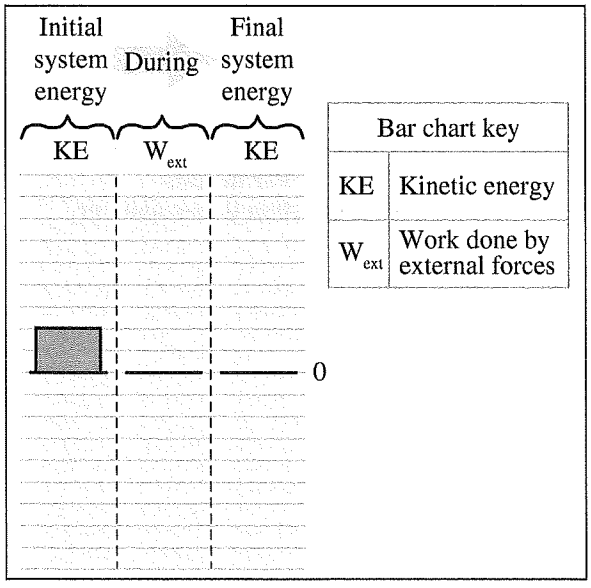


(b) The velocity of a tugboat changes from 2 m/s to 4 m/s in the opposite direction while a force is applied to the tugboat for 20 seconds.

Complete the work and kinetic energy bar chart for this process. The bar heights should be in correct proportion to one another.

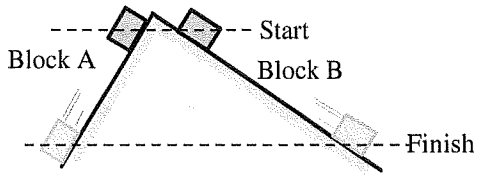


Explain.



B4-SCT19: BLOCKS SLIDING DOWN FRICTIONLESS RAMPS—WORK BY THE NORMAL FORCE

Two identical blocks are released from rest at the same height. Block A slides down a steeper ramp than Block B. Both ramps are frictionless. The blocks reach the same final height indicated by the lower dashed line. Three students are comparing the work done on the two blocks by the normal force:



Annika: *"I think the normal force doesn't do any work on either block. The force on the block by the ramp is perpendicular to the ramp, and the displacement is parallel to the ramp. So the dot product is zero."*

BoBae: *"Work is force times displacement. The work done on Block A is negative, while the work done on Block B is positive, because the displacement for B is in the positive direction, while the displacement for A is in the negative direction."*

Craig: *"Since work is force times distance, and the distance the block travels is greater for Block B, the work done is greater for Block B."*

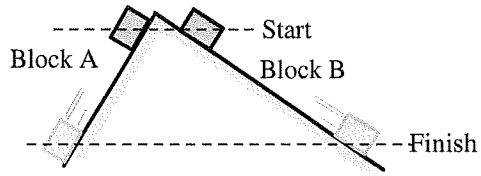
With which, if any, of these students do you agree?

Annika _____ BoBae _____ Craig _____ None of them_____

Explain your reasoning.

B4-SCT20: BLOCKS SLIDING DOWN FRICTIONLESS RAMPS—WORK BY THE EARTH

Two identical blocks are released from rest at the same height. Block A slides down a steeper ramp than Block B. Both ramps are frictionless. The blocks reach the same final height indicated by the lower dashed line. Three students are comparing the work done on the two blocks by the gravitational force (the weight of the blocks):



Asmita: *"Work is related to the product of force and displacement, and the weight is the same since the blocks are identical. But Block B travels farther, so more work is done on Block B by the gravitational force than on Block A."*

Ben: *"Both blocks fall the same vertical distance, so the work done is the same."*

Cocheta: *"By Newton's third law, the force exerted on the block by Earth is exactly cancelled by the force exerted on Earth by the block. The work done is zero."*

Danae: *"The work depends on the angle that the force makes with the displacement. If we put the displacement and force vectors tail-to-tail, the angle is smaller for Block B than for Block A, and so the work done is greater."*

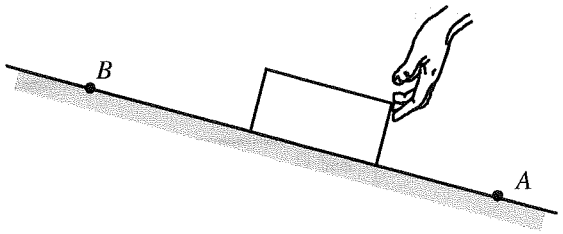
With which, if any, of these students do you agree?

Asmita _____ Ben _____ Cocheta _____ Danae _____ None of them_____

Explain your reasoning.

B4-QRT22: BLOCK ON RAMP WITH FRICTION—WORK AND ENERGY

A block is pushed at constant speed up a ramp from point *A* to point *B*. The direction of the force on the block by the hand is horizontal. There is friction between the block and the ramp. The distance between points *A* and *B* is 1 m.



(a) The kinetic energy of the block at point *B*

(i) is *greater than* the kinetic energy of the block at point *A*.
(ii) is *less than* the kinetic energy of the block at point *A*.
(iii) is *equal to* the kinetic energy of the block at point *A*.
(iv) *cannot be compared* to the kinetic energy of the block at point *A* unless we know the height difference between *A* and *B*.

Explain your reasoning.

(b) The net work done on the block as it travels from point *A* to point *B*

(i) is *zero*.
(ii) is *negative*.
(iii) is *positive*.
(iv) *could be positive or negative* depending on the choice of coordinate systems.

Explain your reasoning.

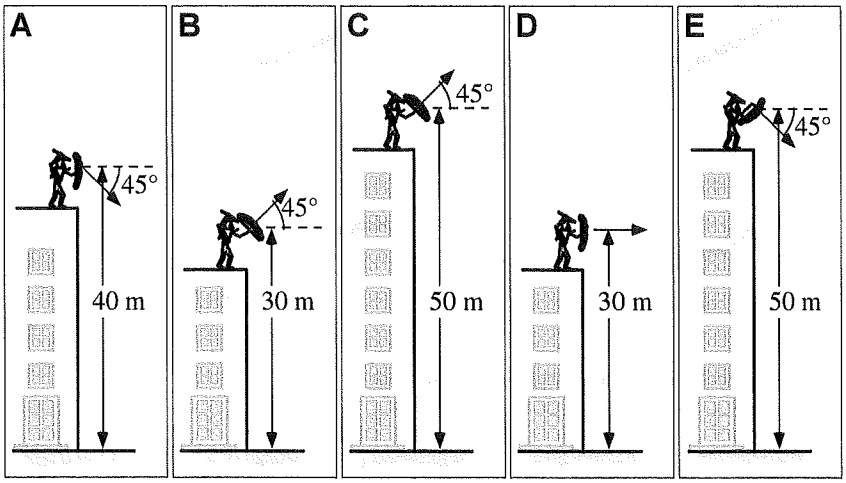
(c) The work done on the block by the hand as the block travels from point *A* to point *B*

(i) is *equal* to 1 m times the magnitude of the force exerted on the block by the hand.
(ii) is *greater than* 1 m times the magnitude of the force exerted on the block by the hand.
(iii) is *less than* 1 m times the magnitude of the force exerted on the block by the hand but not zero.
(iv) is *zero*.
(v) *cannot be compared* to the magnitude of the force exerted on the block by the hand based on the information given.

Explain your reasoning.

B4-RT25: ARROWS SHOT FROM BUILDINGS—FINAL SPEED

In each case below, an arrow has been shot from the top of a building either up at a 45° angle, straight out horizontally, or down at a 45° angle. All arrows are identical and are shot at the same speed, and the heights of the buildings and the direction the arrows are shot are given. Ignore air resistance.



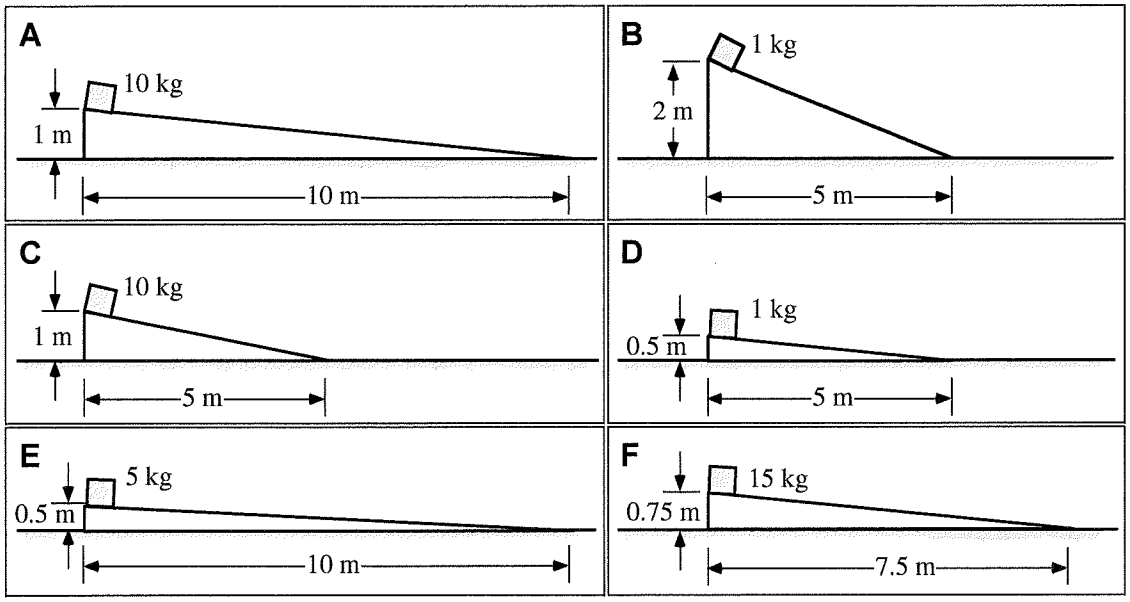
Rank the speed of the arrows just before they hit the ground below.

					OR			
1 Greatest	2	3	4	5 Least		All the same	All zero	Cannot determine

Explain your reasoning.

B4-RT45: Sliding Masses on Incline—Kinetic Energy

Shown are blocks that slide down frictionless inclines. All masses start from rest at the top of the incline.



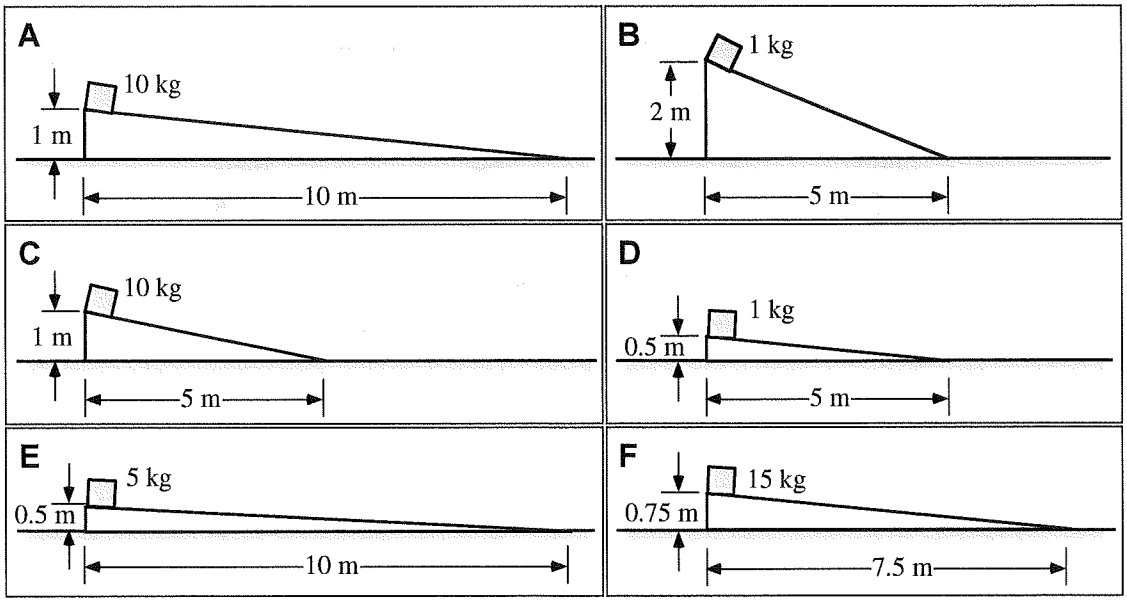
Rank the kinetic energy of the sliding masses the instant they reach the bottom of the incline.

						OR			
1 Greatest	2	3	4	5	6 Least		All the same	All zero	Cannot determine

Explain your reasoning.

B4-RT46: SLIDING MASSES ON INCLINE—CHANGE IN POTENTIAL ENERGY

Shown are blocks that slide down frictionless inclines. All masses start from rest at the top of the incline.



Rank the change in gravitational potential energy of the sliding masses from the top of the incline to the bottom of the incline.

						OR			
1 Greatest	2	3	4	5	6 Least		All the same	All zero	Cannot determine

Explain your reasoning.

B4-CT49: Car Race—Work and Power

Amanda and Bertha are in a car race. Their cars have the same mass. At one point in the race, they both change their speeds by 10 m/s in 2 seconds. Ignore air friction.

(a) Is the work that Amanda's car does while speeding up (i) *greater than*, (ii) *less than*, or (iii) *the same as* the work that Bertha's car does while speeding up? _____

Explain your reasoning.

(b) Is the power generated by Amanda's car while speeding up (i) *greater than*, (ii) *less than*, or (iii) *the same as* the power generated by Bertha's car while speeding up? _____

Explain your reasoning.