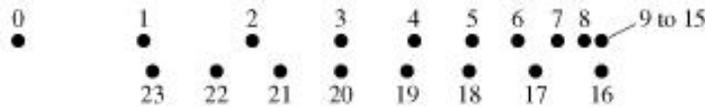
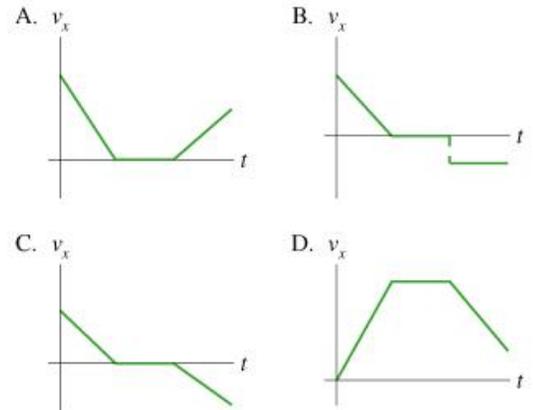


Part A of the exam consists of 20 questions. Remember that even though some of these questions are multiple choice questions, you still can get partial credit by showing your work. When you are done with Part A, turn it in at the front of the class and pick up Part B. Have fun!

1) The figure below is a motion diagram with the clock reading (in seconds) shown at each position. The positions for  $t \geq 16$  s are offset for clarity, but the motion actually occurs along a single track.



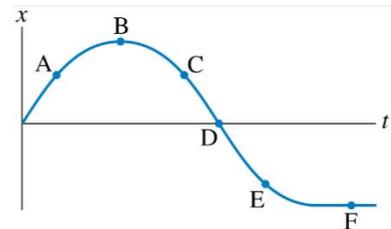
Which graph on the right best represents the object's velocity?



2) An object has a velocity directed to the right, and an acceleration directed to the left. Which statement is true?

- The position of the object is increasing to the left with time, and its speed is increasing.
- The position of the object is increasing to the right with time, and its speed is increasing.
- The position of the object is not changing in time.
- The position of the object is increasing to the right with time, and its speed is decreasing.
- There is not enough information given to answer this question

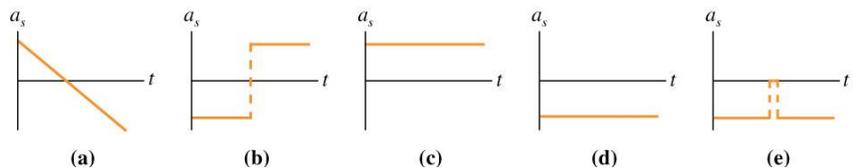
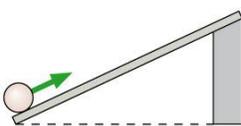
3, 4) The figure on the right shows the position versus time graph of an ice skater on a frozen lake. The coordinate  $x$  is pointing to the right. At which lettered point or points:



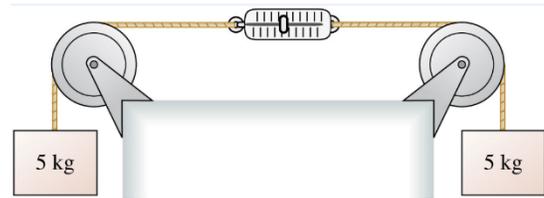
- A. Is the ice skater moving the fastest?
- B. Is the skater moving to the left?
- C. Is the skater speeding up?
- D. Is the skater turning around?
- E. Is the skater at rest?

Make sure you mark all possible answers.

5) The ball rolls up the ramp, then back down. Which is the correct acceleration graph? The ball rolls initially in positive direction of the coordinate system. Circle the correct graph.



- 6) The figure shows two masses at rest. The string is massless and the pulleys are frictionless. The spring scale reads in kg. What is the reading of the scale?



- 7) (2pts) You throw a snowball into the air (obviously with no bad intentions (-: )) at a  $33^\circ$  angle above the horizontal. At its highest point....
- A. ...the velocity = 0 m/s  True  False
- B. ...the acceleration = 0 m/s<sup>2</sup>  True  False

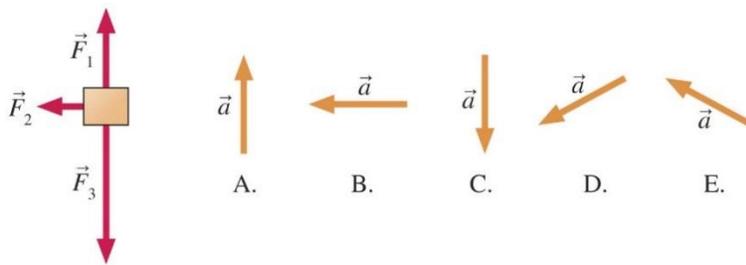
- 8) This ice skater is skating on frictionless ice. Draw a free body diagram. A free body diagram includes the net force and a coordinate system.



- 9) The elder of you might remember Eddie the eagle competing in the ski jumping competition of the winter Olympics 1988 in Calgary. Draw a free-body diagram for Eddie. Clearly show the net force on the side of your free-body diagram.

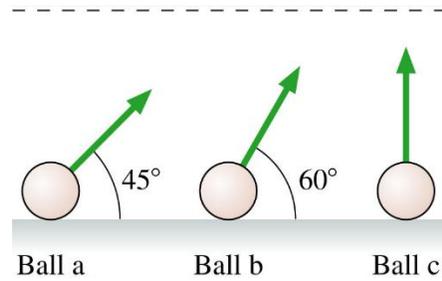


- 10) Three forces act on a little box. In which direction does the box accelerate?

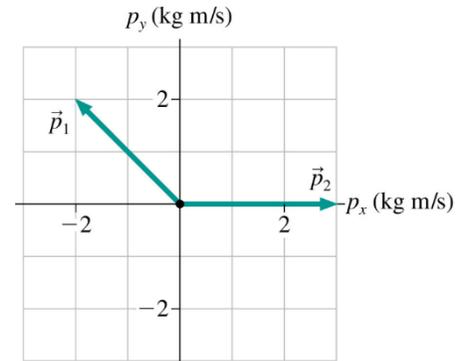


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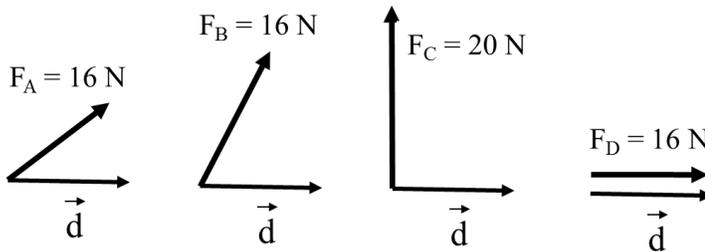
11. The three balls on the right, which have equal masses, are fired with equal speed at the angles shown. Rank in order, from smallest to largest, their speeds  $v_a$ ,  $v_b$ , and  $v_c$ , as they cross the dashed horizontal line. All three balls are fired with sufficient speed to reach the line.



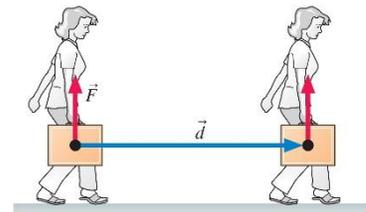
- 12) To secure the slopes in a ski area a large snow cornice is blasted apart. It bursts into 3 fragments. The momentum vectors of two of the fragments are shown in the figure. Draw in the momentum vector of the third fragment.



- 13) Rank the forces A - D by the work they perform on an object moving by a distance  $d$ .



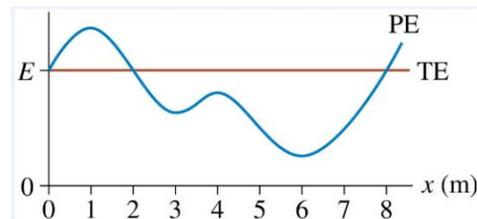
- 14) The woman in the picture carries a suitcase. The suitcase has a mass of 23.7 kg, and she carries it for 2.50m. What is the work she performs on the suitcase?



- 15) What energy transformations occur as a skier glides down a gentle slope at constant speed?

16) Enthusiastically you are running to your physics final. You are passing a few kindergarten kids and you estimate your relative speed and mass. Using the equally spaced trees on the street you measure that you are 4 times faster than the kids walk. In your head you quickly calculate that your kinetic energy is 48 times the kinetic energy of the kids. How many times heavier did you assume you are relative to the kids?

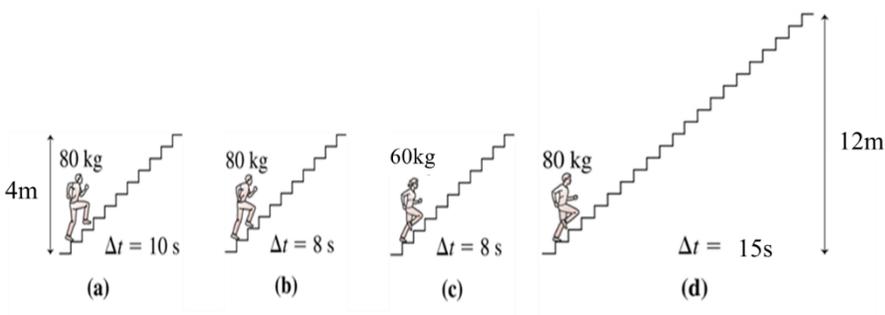
17) (3pts) A skateboarder with the potential energy shown in the figure is boarding to the right at  $x = 5\text{m}$  with total Energy TE.



- At what value or values of  $x$  is this snowboarder's speed a maximum?
- Does this snowboarder have a turning point or points in the range of  $x$  covered by the graph? If so, where?
- If  $E$  is changed appropriately, could the particle remain at rest at any point or points in the range of  $x$  covered by the graph. If so, where?

18) The motor of a crane uses power and output  $P$  to lift a steel beam. By what factor must the motor's output increase to lift the beam twice as high in half the time?

19) Four students run up the stairs in the time shown. Rank in order, from largest to smallest, their power outputs  $P_a$  to  $P_d$ .



20) (2pts) Make sure that your name is on the front page of this part of the exam and turn it in at the front of the room. Then, pick up Part B and keep going!