11 Physics **Work and Energy Problems** Date:_____

1. A horse pulls a 125 kg wagon that was initially at rest. The horse exerts an average horizontal force of 525 N to move the wagon 18.3 m. The force exerted by the horse then changes to 345 N while the horse pulls the wagon an additional distance of 13.5 m. Find the total work done by the horse on the wagon.

2. A young girl pushes her 12.0 kg toy box a distance of 12.0 m along a horizontal hallway floor at a constant velocity. She applies a force of 57.6 N forward to the box as she moves it.
   a) Find the work done by the girl on the box. b) Find the work done by friction on the box.

3. A 55 kg rugby player travelling at 6.3 m/s moves toward a 95 kg rugby player running at 4.2 m/s. Which player has more kinetic energy?

4. A cyclist doubles his speed from 5.0 m/s to 10.0 m/s. How has his kinetic energy changed?

5. Neglecting friction, how much work must be done on a 1200 kg car to increase the speed of the car from 14 m/s to 28 m/s?

6. A 252 g hockey puck is accelerated from rest over smooth ice as a hockey player hits a slapshot. The hockey player exerts an average force of 46.0 N over a distance of 0.750 m while the stick is in contact with the puck. Assuming friction can be ignored, find:
   a) the work done by the hockey player on the puck
   b) the puck's initial kinetic energy and its final in kinetic energy after being accelerated
   c) the puck's final speed

7. A 75 kg passenger in a van is wearing a seat belt when the van, moving initially at 15 m/s, collides with a large tree. The front end of the van collapses 0.50 m as it comes to rest.
   a) What is the passenger's kinetic energy before the crash?
   b) What is the passenger's change in kinetic energy?
   c) What average force did the seat belt exert on the passenger during the crash?

8. A physics student slides her textbook along the table to her deskmate by giving the 1.4 kg textbook an initial push. Once the book is sliding, it travels a distance of 0.76 m before coming to rest. The coefficient of kinetic friction between the table and the book is 0.35.
   a) Draw a freebody diagram for the book as it slides along.
   b) Determine the force of kinetic friction on the book.
   c) Determine the work done by kinetic friction on the book as it slides along.
   d) Find the initial speed of the book.

9. Jack does 572 J of work to raise a pail of water 2.90 m up a well at a constant speed.
   a) What force did Jack exert on the pail of water?
   b) What is the mass of water in the pail?

Answers:

1. $Wt_{total} = 1.43 \times 10^4$ J 2. a) $W_{app} = 691$ J b) $W_{friction} = -691$ J 3. Ek_1 (1.1×10^3 J) > Ek_2 (8.4×10^2 J)
4. $Ek_2 = 4\ Ek_1$ 5. 3.53×10^5 J 6. a) 34.5 J, b) 0J, 34.5 J c) 16.5 m/s
7.a) 8.4×10^3 J b) -8.4×10^3 J c) 1.7×10^4 N 8. b) 4. 8 N c) -3.6 J d) 2.3 m/s
9. a) 197 N b) 20.1 kg