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**Physics 2204 – Unit 3 Worksheet 13 – Power and Efficiency – 2007- 08**

Name: \_\_\_\_\_ School: \_\_\_\_\_

1. a) A small snowmobile is rated at 12.0 hp (note that  $1 \text{ hp} = 746 \text{ W}$ . Convert!). It takes a force of 300.0 N to move a sled load of wood along a pond. How long will it take to tow the wood across the pond if the distance is measured to be 846 m?
  - b) A more powerful snowmobile could also be used to tow sleds of wood that are identical to the one in the previous question. Use your understanding of the concept *power* to explain how the situation would be different if a more powerful machine was used.
2. a) A winch is rated at 720 W. It is used to pull a quad runner out of the bog, a distance of 2.30 m. The average force applied by the winch is 1520 N. How long will the job take?
3. a) Jack and Jill went up the hill (The hill was 20.0 m high). Each carrying a sack of flour (flour: 20.0 kg, Jack: 70. kg) Jack made the trip in 40 sec. What was old Jacky's power?
  - b) Jill goes to aerobics class (Jill: 60.0 kg) and works out as well in the gym she did the trip in 10 seconds less (She also had a sack of flour) compare her power to Jack's.

4. What is your power output if you have a mass of 65.0 kg and you climb a 5.2 m vertical ladder in 5.2 s?
5. The maximum power output of a crane is 12.0 kW. What is the fastest time in which such a crane can lift a 3500 kg crate a height of 6.0 m?
6. A quad runner with a weight of 2450 N needs to be raised to a height of 0.60 m so it can be placed in the pan of a pickup truck.
- a) Use the given information to calculate  $W_{out}$ .
- b) Several planks are used to make a ramp that is 2.5 m long. With the ramp an applied force of 625 N can be used to move the Quad into the truck. Use this information to calculate  $W_{in}$ .
- c) Use parts a) and b) to help you to calculate e.

7. With a block and tackle arrangement, a relatively small force applied over a large distance can be used to apply a large force over a smaller distance.
- a) An long-liner needs to be moved for a distance of 15.0 m using an average applied force of 9500 N. Calculate  $W_{out}$ .
- b) A block and tackle is able to move the vessel using an input force of 1500 N. The user must, however, haul in 100.0 m of rope to move the vessel the required distance. Calculate  $W_{in}$ .
- c) Use parts a) and b) to help you calculate e.
8. A wheel and axle system is estimated to be 75% efficient. What  $W_{out}$  is obtained if a force of 250 N is used to move the outer part of the wheel through a distance of 0.82 m?