## Challenge Exercises for Further Study

B-1: $\quad$ A $5.00-\mathrm{N}$ salmon swims 20.0 m upstream against a current that provides a resistance of 1.50 N . This portion of the stream rises at an angle of $10.0^{\circ}$ with respect to the horizontal. a) How much work is done by the salmon against the current? b) What is the gain in PE by the salmon? c) What is the total work that must be done by the salmon? d) If the salmon takes 40.0 s to swim the distance, what power does it exert in doing so?

B-2: $\quad$ A 30-kg shopping cart full of groceries sitting at the top of a $2.0-\mathrm{m}$ hill begins to roll until it hits a stump at the bottom of the hill. Upon impact, a $0.25-\mathrm{kg}$ can of peaches flies horizontally out of the shopping cart and hits a parked car with an average force of 490 N . How deep a dent is made in the car?

B-3: $\quad$ Using her snowmobile, Midge pulls a $60.0-\mathrm{kg}$ skier up a ski slope inclined at an angle of $12.0^{\circ}$ to the horizontal. The snowmobile exerts a force of $200 . \mathrm{N}$ parallel to the hill. If the coefficient of friction between the skis and the snow is 0.120 , how fast is the skier moving after he has been pulled for 100.0 m starting from rest? (Ignore the effects of the static friction that must be overcome to initially start him in motion.) Use the law of conservation of energy.

B-4: $\quad$ Jose, whose mass is 45.0 kg , is riding his $5.0-\mathrm{kg}$ skateboard down the sidewalk with a constant speed of $6.0 \mathrm{~m} / \mathrm{s}$ when he rolls across a 10.0-m-long patch of sand on the pavement. The sand provides a force of friction of 6.0 N . What is Jose's speed as he emerges from the sandy section?

B-5: $\quad$ Eben lifts an engine out of his Volkswagen with the help of a winch that allows him to raise the engine 0.020 m for every 0.90 m he pulls on the cable. Eben expends 1000 . J of energy to lift the $800 .-\mathrm{N}$ engine 0.50 m . a) What is the efficiency of the winch? b) What is the ideal mechanical advantage of the winch? c) What is the actual mechanical advantage of the winch? d) What force does Eben exert to lift the engine?

