SPH3U **Energy and Society Exam Review**

1. A force of 5.0 N moves a 6.0 kg object along a rough floor at a constant speed of 2.5 m/s.
   (a) How much work is done by the applied force?
   (b) What power is being used in 25s?
   (c) What force of friction is acting on the object?

2. A girl pushes her little brother on his sled with a force of 300. N for 750. m. How much work is this if the force of friction acting on the sled is 200 N ?

3. A mechanic uses a chain and block pulley to lift a 875-kg engine 4 m to the top of the garage. The downward force on the chain over the 4 m distance is 5×10^4 N
   (a) Calculate the work done in raising the motor?
   (b) How much useful work was done?
   (c) What is the efficiency of the chain and block pulley in raising the motor?

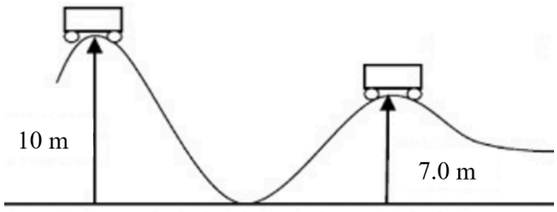
4. What is the gravitational potential energy of a 61.2 kg person standing on the roof of a 10-story building relative to (a) the tenth floor, (b) the sixth floor, (c) the first floor? (Each story is 2.50 m high.)

5. A coconut falls out of a tree 12.0 m above the ground and hits a bystander 3.00 m tall on the top of the head. It bounces back up 1.50 m before falling to the ground. If the mass of the coconut is 2.00 kg, calculate the potential energy of the coconut relative to the ground at each of the following sites:
   (a) while it is still in the tree,
   (b) when it hits the bystander on the head,
   (c) when it bounces up to its maximum height,
   (d) when it lands on the ground,
   (e) when it rolls into a groundhog hole, and falls 2.50 m to the bottom of the hole.

6. The tallest roller coaster in North America is 94.5 m high at its highest point. What is the maximum possible speed of the roller coaster?

7. How long would it take a 500W electric motor to do 1.50×10^5 J of work

8. A 5000 kg roller coaster (illustrated below) starts from rest at a height of 10 m. Neglect friction.
(a) Calculate its gravitational potential energy at a height of 10 m relative to the ground.
(b) Calculate its kinetic energy and speed at a height of 7 m.



9. A 50.0 kg bicyclist on a 10.0 kg bicycle speeds up from 5.00 m/s to 10.0 m/s.
   (a) What was the total kinetic energy before accelerating?
   (b) What was the total kinetic energy after accelerating?
   (c) How much work was done to increase the kinetic energy of the bicyclist?
   (d) Is it more work to speed up from 0 to 5.00 m/s than from 5.00 to 10.0 m/s?

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   (a) What was the total kinetic energy before accelerating?
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   (d) Is it more work to speed up from 0 to 5.0 m/s than from 5.0 to 10.0 m/s?

11. Jack (m = 80 kg) and Jill (m = 60 kg) went up a hill (32 m high) to fetch a pail of water.
   (a) How much work did Jack have to do in order to climb the hill?
   (b) How much gravitational potential energy does Jack have at the top of the hill?
   (c) If it took Jack 40 s to climb the hill, how much power did Jack generate?
   (d) When Jack falls down the hill, how fast will he be going when he gets to the bottom?

12. A 4.00 kg ball is on a 5.00 m ledge. If it is pushed off the ledge, how much kinetic energy will it have just before hitting the ground?

13. A 4357-kg roller coaster car starts from rest at the top of a 36.5-m high track. Determine the speed of the car at the top of a loop that is 10.8 m high.

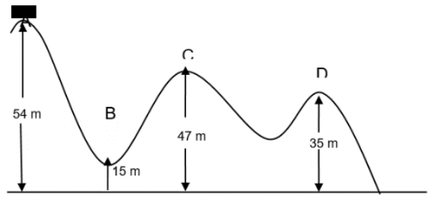
14. A 35.0 kg monkey swings from a mango tree that is 14.6 m high. At a certain point in his swing, his speed is 14.0 m/s. Use the law of conservation of energy to determine how high above the ground the monkey is at this point? Ignore air resistance.

15. A 500.0 kg pig is standing at the top of a muddy hill on a rainy day. The hill is 100.0 m long with a vertical drop of 30.0 m. The pig slips and begins to slide down the hill. What is the pig's speed at the bottom of the hill?

16. A 4.1 x 10^4 kg roller coaster (illustrated below) starts from rest at point A. Neglecting friction.

a) Calculate its gravitational potential energy at point A relative to the ground

b) Calculate its kinetic energy and speed at point B



17. A boy on a bicycle drags a wagon full of newspapers at 0.80 m/s for 30 min using a force of 40 N. How much work has the boy done? What is his power output?

18. A 50.0 kg gorilla is sitting on the limb of a tree 4.00 meters above the ground. The gorilla jumps down from the tree limb to the ground. Use the conservation of energy to find the velocity of the gorilla just before hitting the ground.

19. During an experiment a Physics student places a 300.0 g piece of copper in boiling water at 100.0^{0}C for 10.0 minutes. She then transfers the copper into 200.0 g of water [c_w = 4180 J/kg^{o}C] at 10^{o}C. The final temperature of the water and of the copper becomes 21^{o}C. Find the specific heat capacity for the copper.

20. A $0.25\ kg$ glass of water at $20°C$ is put into the freezer. After 1 hour, it is ice at $-\ 10°C$. How much thermal energy has been removed from the water? The specific heat capacity of water is 4186 J/kg / ^{o}C and the latent heats of fusion and vaporization are 333,000 J/kg and 2,260,000 J/kg, respectively.

21. A 4.5 kg block of ice at 0^o C is heated up causing it to melt and then heat up to a temperature of 85^o C. Determine the total amount of thermal energy required to do this. The specific heat capacity of water is 4186 J/kg / ^{o}C and the latent heats of fusion and vaporization are 333,000 J/kg and 2,260,000 J/kg, respectively.

22. A 15.75-g piece of iron absorbs 1086.75 joules of heat energy, and its temperature changes from 25°C to 175°C. Calculate the specific heat capacity of iron.

23. A 37 kg boy climbs up a tree starting at 2.8 m to 7.5 m above the ground. If he does this in 6.2 seconds, what is his power output?

24. How many joules of heat are needed to raise the temperature of 10.0 g of aluminum from 22°C to 55°C, if the specific heat of aluminum is 0.90 J/g°C?

25. To what temperature will a 50.0 g piece of glass raise if it absorbs 5275 joules of heat and its specific heat capacity is 0.50 J/g°C? The initial temperature of the glass is 20.0°C.

26. Calculate the heat capacity of a piece of wood if 1500.0 g of the wood absorbs 6.75×10^4 joules of heat, and its temperature changes from 32°C to 57°C.