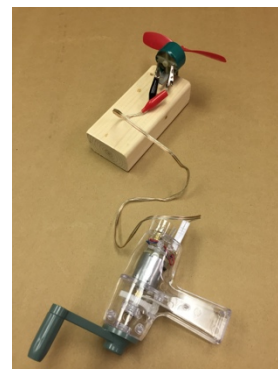


## Darwin wonders about the hand cranked generator and red propeller Interpretation Guide



Darwin, the dog, watches Tomas explore electrical energy. Tomas turns the handle of a generator which is connected by wires to a motor and red propeller. Darwin sees that when Tomas turns the handle in one place the propeller is spinning in another place.



1. Think about the red propeller.

a. When Tomas begins to turn the handle of the generator, does the red propeller

- ☒ Gain energy? **The propeller begins to spin (move) and is speeding up so it must be gaining energy.**
- ☐ Lose energy? **It is rare that students choose this option.**
- ☐ Neither gain nor lose energy? **Students may think that the propeller starts moving but does not gain energy.**
- ☒ Both gain and lose energy? **Some students may recognize that as soon as the propeller begins to spin it will be transferring energy to the surrounding air.**

The statement makes sense to me because:

**Students may say this makes sense because the generator is giving or transferring energy to the propeller or they may say that the propeller begins to move which indicates it has gained energy.**

b. Tomas keeps turning the handle and sees that the propeller spins in a steady way. While it is spinning, does the red propeller

- ☐ Gain energy? **Students may think that when the propeller is spinning it is gaining energy.**
- ☐ Lose energy? **It is rare that students choose this option.**
- ☐ Neither gain nor lose energy? **Students who are focusing on the motion energy of the propeller may recognize that the motion energy is neither increasing nor decreasing. They may not realize that it is both gaining energy from the generator and losing energy to the air.**
- ☒ Both gain and lose energy? **If Tomas keeps turning the handle, you might expect the propeller to go faster and faster as it gains more and more energy, but it doesn't! Therefore, it must also be losing energy, in this scenario to the surrounding air.**

This statement makes sense to me because:

**Many students may recognize that when the propeller spins in a constant way the motion energy is no longer increasing. They may also realize that the generator is still transferring energy to the propeller and wonder why the motion energy has stopped increasing. They may recognize that the propeller is transferring energy to the air.**

2. Darwin sees that when Tomas turns the handle of the generator the propeller turns. But the wires that connect them don't move at all. He wonders how this is possible.



Explain how this is possible. (Use diagrams, words and/or the Energy Tracking Lens to tell the energy story).

Students will have lots of ideas about how wires might be involved in the energy story of the handle and propeller. Some students may recognize that the motion energy of the propeller provides evidence of an energy transfer through the wires. Some students may reason that the energy cannot be transferred as motion energy if the wires do not move. They may describe the energy that is transferred through the wires as electrical energy or electricity. Students who have studied electric circuits may have ideas about how a complete circuit is related to the transfer of energy.