

Lesson 1

How Are Kinetic and Potential Energy Related?

You will learn:

- what kinetic energy is.
- what potential energy is.
- how energy changes between kinetic and potential energy.

You are in the front car of a roller coaster as it reaches the top of the first hill. **ZOOM!** You rush down the track at breakneck speed. Your friend is screaming so loudly you can't even think. You're experiencing the energy of motion!

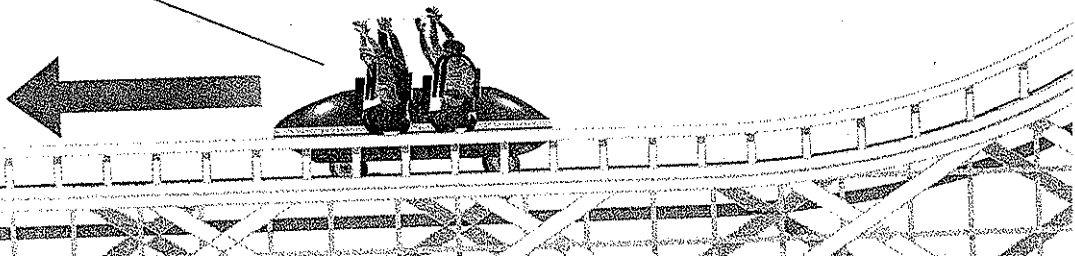
Kinetic Energy

Amusement parks use energy to make their rides exciting. Energy is the ability to do work. Here, *work* is a scientific term. You do work whenever you apply a force (a push or a pull) and move an object some distance. The more energy there is, the more work can be done.

You could use amusement park rides to investigate work. Imagine you are driving slowly in a bumper car. You bump, or apply a force to, your best friend's car and push it a short distance. You explain to your friend that you have just done some work. What would happen if you were moving faster the next time you bumped your friend's car?

Most Kinetic Energy

At the bottom of the hill, the car's speed is the greatest, but it is no longer accelerating. Its kinetic energy is greatest but is no longer increasing.



Glossary

kinetic (ki net'ik)
energy, the energy
of motion

The energy you or any object has because of its motion is called **kinetic energy**. The faster an object moves, the more kinetic energy it has. When your bumper car moves faster, it can do more work to your friend's car. You can push it farther.

When you're finished with the bumper cars, you and your friend decide to ride the roller coaster. Study the roller coaster on these two pages. Where do you go the slowest? Where is your kinetic energy the least? Where do you go the fastest? Where is your kinetic energy the greatest? What is the scariest part?

Kinetic Energy Increasing
As the car goes down the hill, it moves faster and faster. Its kinetic energy is increasing.

Least Kinetic Energy

At the top of the hill, the car is barely moving. Its kinetic energy is almost zero, but not for long!



Glossary

potential (pə ten/shəl),
energy, stored energy
or energy that an object
has due to its position

Potential Energy

Scientists classify all energy as either kinetic energy or potential energy. **Potential energy** is stored energy or energy that an object has due to its position.

When you begin your roller-coaster ride, electric motors in the roller coaster move your car slowly up a long, steep hill. As it reaches a higher and higher position, your car has more and more potential energy. When you reach the top, your car has its greatest potential energy.

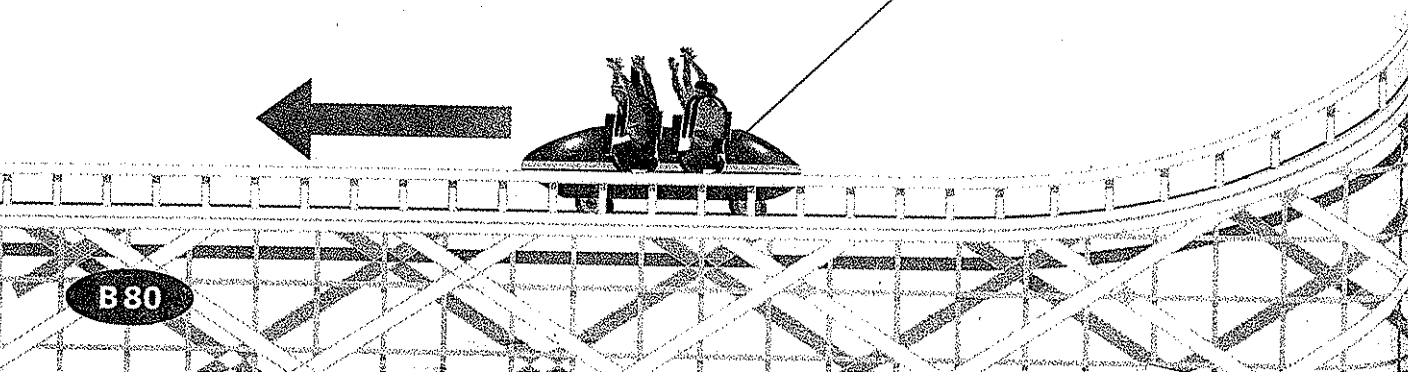
Find the car at the top of the hill on the next page. In this position, the car has high potential energy. It is possible for it to plunge down the track.

When the car reaches the bottom, it has used up its potential energy. Although it keeps moving along, it cannot go any faster. How much potential energy does the car have when it is halfway down the hill compared to what it had when it was at the top of the hill?

The potential energy of an object is not always due to its height. In a windup toy, energy is stored in the tightly wound spring. Even atoms—in the way they're connected to each other—can store energy. That's how a radio's batteries store the energy you use to make it play. Energy is stored in this same way in the food you need to live.

Least Potential Energy

At the bottom of the hill, the car is at the lowest point. It has used up all its potential energy. Although its speed is greatest, it has no potential to go any faster.

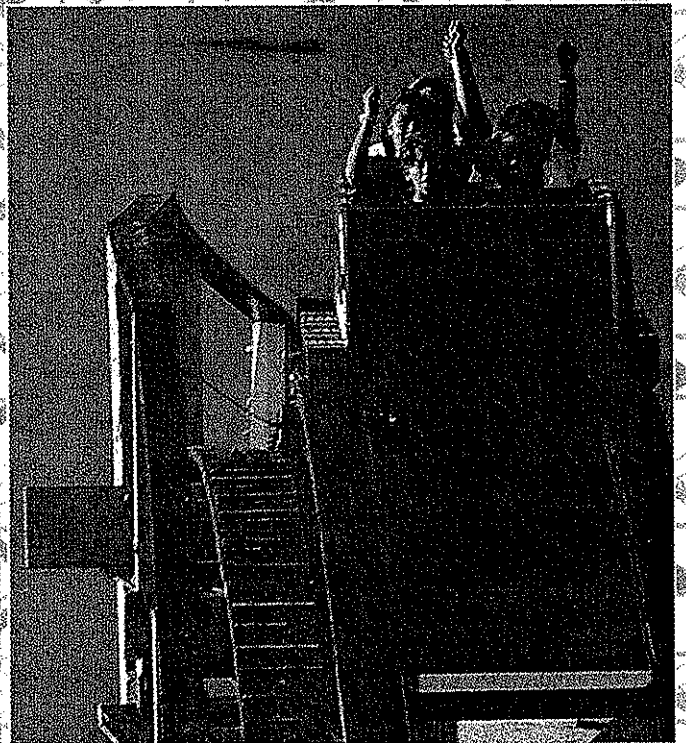
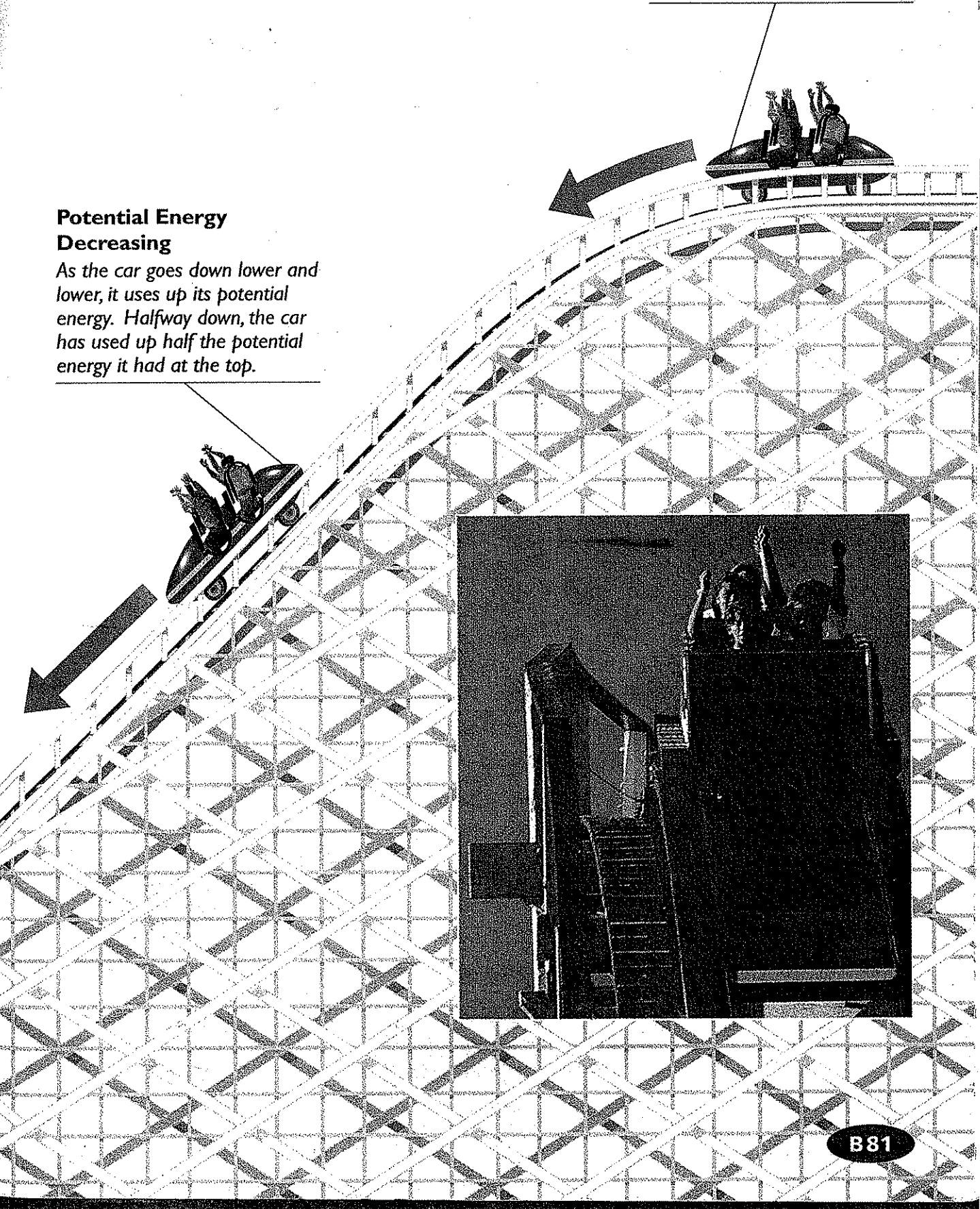


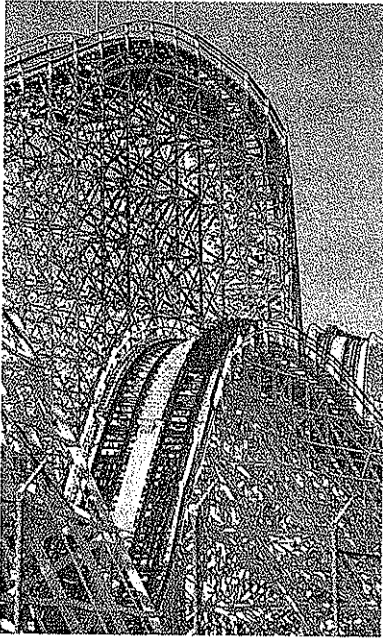
Most Potential Energy

At the top of the hill, the car is at its greatest height, and because of its position the car's potential energy is the greatest.

Potential Energy Decreasing

As the car goes down lower and lower, it uses up its potential energy. Halfway down, the car has used up half the potential energy it had at the top.





▲ Riding a roller coaster is a fun way to study science.

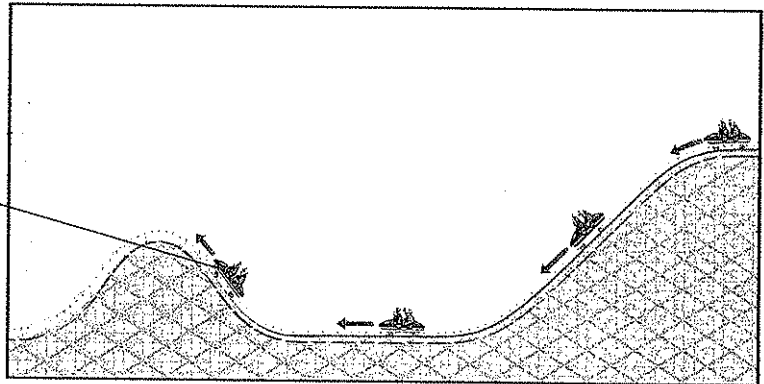
Changing Between Kinetic and Potential Energy

You've learned about potential energy and kinetic energy by studying a roller coaster. You can also use a roller coaster to learn how potential energy changes to kinetic energy. Start at the top of the hill on the next page and follow the roller coaster downhill to find how the energy changes. Then look at the small drawing below to find what happens next. The total amount of energy does not increase or decrease—it just changes between kinetic and potential energy.

Next time you ride a roller coaster such as the one in the picture, think about how your ride is made possible by changes between kinetic and potential energy.

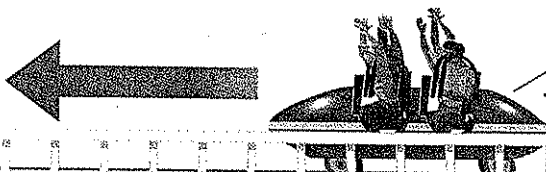
Kinetic Energy Changing to Potential Energy

When the car begins to zoom back up the next hill, the process reverses. The higher the car goes, the more potential energy it has and the slower it moves. Its potential energy increases as its kinetic energy decreases—but just wait for the next drop!



Least Potential Energy and Most Kinetic Energy

At the bottom of the hill, all the car's potential energy has been changed to kinetic energy. The car is at its lowest point, but it is going its fastest.

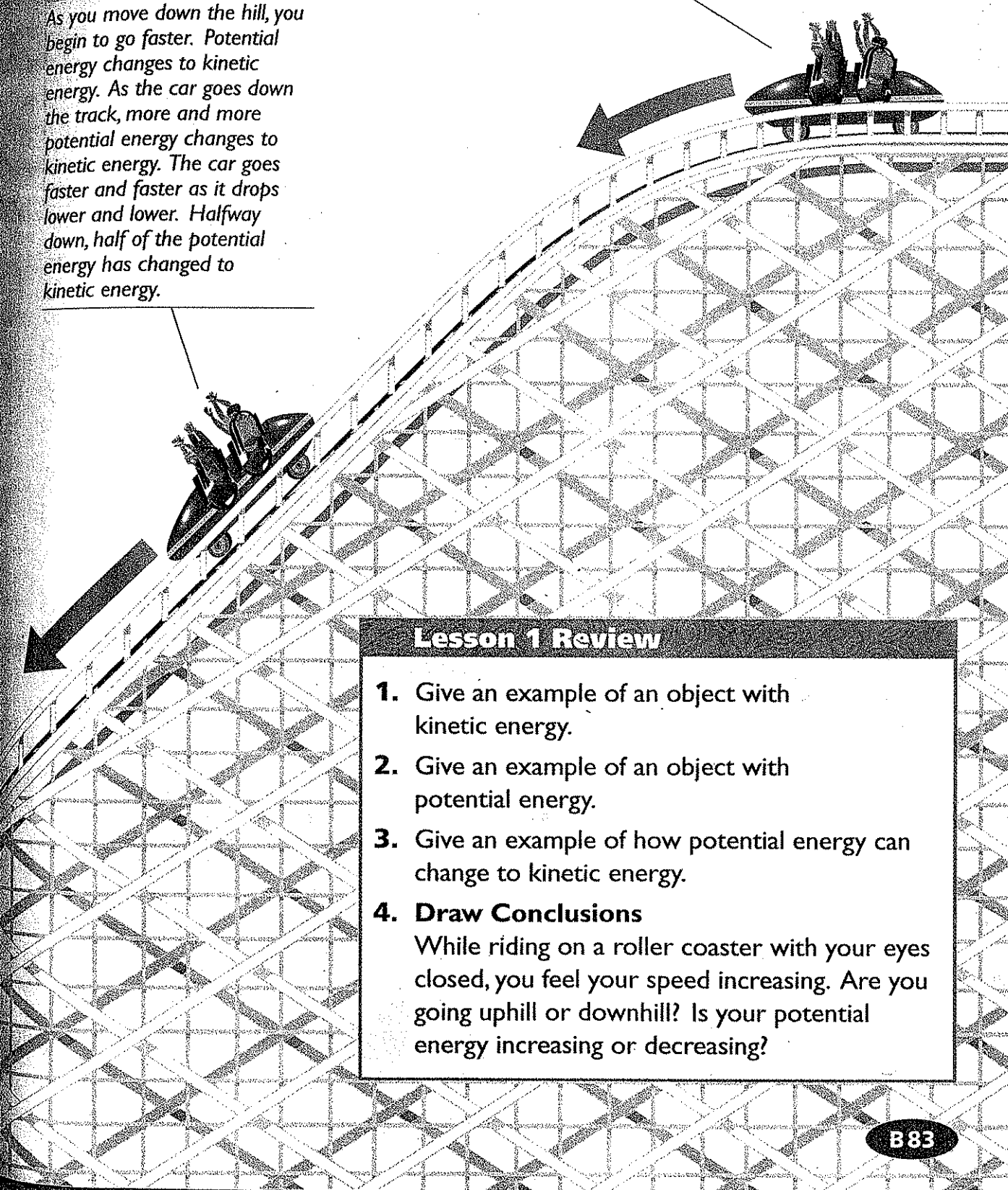


Most Potential Energy and Least Kinetic Energy

At the top of the hill, the car is at its greatest height. Because of this position, it has the most potential energy. Because the car is almost stopped, it has the least kinetic energy.

Potential Energy Changing to Kinetic Energy

As you move down the hill, you begin to go faster. Potential energy changes to kinetic energy. As the car goes down the track, more and more potential energy changes to kinetic energy. The car goes faster and faster as it drops lower and lower. Halfway down, half of the potential energy has changed to kinetic energy.



Lesson 1 Review

1. Give an example of an object with kinetic energy.
2. Give an example of an object with potential energy.
3. Give an example of how potential energy can change to kinetic energy.
4. **Draw Conclusions**

While riding on a roller coaster with your eyes closed, you feel your speed increasing. Are you going uphill or downhill? Is your potential energy increasing or decreasing?