



HI-LO READING · MACHINES & MOTORS

ROLLER COASTERS

GRAVITY DOES THE WORK



INSIDE

- A 4-page article with a Read It Right question beside the text
- Climb the Word Hill: match 10 New Words to their meanings
- Fill-in sentences, a word sort and Strange But True facts
- A think-and-write question
- A 12-question test on 2 pages, plus a full answer key

ROLLER COASTERS



GRAVITY DOES THE WORK

Name _____ Date _____



What keeps the cars moving—and the riders in their seats? A roller coaster train has no engine on board. Once it is let go at the top of the first hill, it races through drops, curves, and loops on its own. It may feel wild, but every part of the ride is planned.

Most rides start on the **lift hill**, the first big climb. On many coasters, a long chain runs up the middle of the track. Hooks under the train catch the chain, and a motor drags the train

to the top. That clack, clack, clack on the way up is the **anti-rollback** system. Metal catches under the train drop into notches along the track. If the chain ever stopped, they would keep the train from rolling back down.

READ IT RIGHT

What makes the clack, clack sound on the lift hill?

Fill in the best answer.

- ☐ the launch magnets
- ☐ the riders' feet
- ☐ the brakes
- ☐ the anti-rollback catches



Some coasters skip the slow climb. Instead, they **launch** the train, flinging it forward with strong magnets or other machines. A launch can get a train up to highway speed in just a few seconds.

Gravity Takes Over

At the top, the motor's job is done. Now **gravity**, the pull that brings things down toward Earth, takes over. High on the hill, the train holds stored **energy**, the power to make

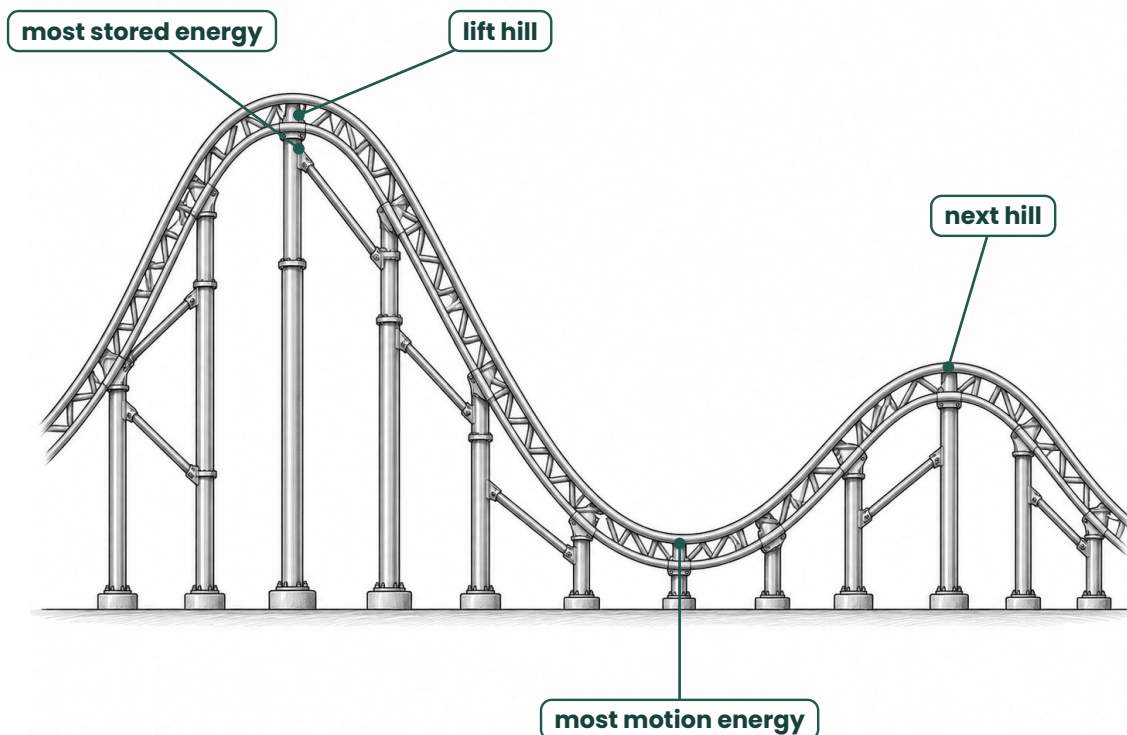
READ IT RIGHT

What do the upstop wheels do?

Fill in the best answer.

- ☐ make the car go faster
- ☐ keep the car from lifting off
- ☐ hold up the car's weight
- ☐ stop the train

things move. As the train dives, stored energy turns into motion energy, and the train speeds up. Climbing the next hill turns it back, and the train slows.



High on the hill, the train stores energy. At the bottom, it moves fastest.



Locked to the Track

A coaster car doesn't just sit on top of the rails. Near each corner, most cars have a wheel set that grips the rail from three sides. On top, **road wheels** roll along and carry the weight. Side wheels press on the side of the rail and steer the car through curves.

Under the rail are the **upstop wheels**. They keep the car from lifting off the track over the top of a hill or upside down in a loop.

Safe in Your Seat

Each rider is held in by a **restraint**, like a lap bar or a shoulder harness. Many lock with more than one catch, in case one fails. On many rides, sensors check every restraint. If one is not locked, the train can't leave the station.

Slowing Down

At the end of the ride, the train has to stop. Many coasters use **magnetic brakes**. Metal fins on the train slide between strong magnets on the track. The magnets slow the fins without ever touching them, and most work even if the power goes out. But they can't hold a train still, so other brakes finish the stop.

READ IT RIGHT

Which brakes slow the train without touching it?

Fill in the best answer.

- ☐ foot brakes
- ☐ hand brakes
- ☐ magnetic brakes
- ☐ chain brakes



A Real Job

Ride mechanics keep coasters safe. Each morning before the park opens, they do an **inspection**, a careful check of the wheels, brakes, restraints, and track. Then they send the empty train around for test runs. Many start with a high school diploma and learn on the job. The government doesn't list pay for ride mechanics alone. But for general maintenance and repair workers, a similar job, half earned more than about \$49,600 in 2025.





CLIMB THE WORD HILL



Write the letter of the meaning on each line.

1. lift hill

a. brakes that slow metal fins without touching them

2. anti-rollback

b. a careful check for problems

3. launch

c. catches that keep a train from rolling back down

4. gravity

d. the power to make things move

5. energy

e. a lap bar or harness that holds a rider in

6. road wheels

f. the pull that brings things down toward Earth

7. upstop wheels

g. to fling a train forward fast

8. restraint

h. wheels under the rail that keep the car on

9. magnetic brakes

i. wheels that roll on top of the rail

10. inspection

j. the first big climb at the start of a ride



FILL THE TRAIN



Write the New Word that best completes each sentence.

NEW WORDS

lift hill

anti-rollback

launch

gravity

energy

road wheels

upstop wheels

restraint

magnetic brakes

inspection

1. The train crawled up the tall _____ before the first drop.
2. Clack, clack, clack went the _____ catches as the train climbed.
3. This ride will _____ you from 0 to 60 miles per hour in seconds.
4. When you drop a pencil, _____ pulls it to the floor.
5. The worker pulled down each _____ and checked that it was locked.
6. Under the rail, the _____ keep the car from flying up.
7. Fins on the train slid through the _____ at the end of the ride.
8. Every morning, the mechanic does an _____ of the whole ride.



SORT THE STATION



Read each group. Circle the three words that belong.

1. kinds of coaster wheels

road wheels side wheels upstop wheels
steering wheel

2. things a ride mechanic checks each morning

wheels brakes restraints ticket prices

3. true about magnetic brakes

never touch fins slow the train
use metal fins hold train still

4. what happens on a chain lift hill

chain pulls train catches drop in
clacking sound brakes stop it

5. parts of the safety system

restraints sensors anti-rollback
first drop

STRANGE BUT TRUE

COASTER FACTS

In 1884, one of the first coasters in America opened in New York. It went about 6 miles an hour. A ride cost 5 cents.

In 1919, John Miller got a patent for the upstop wheel. It let builders add steep drops and sharp curves without cars flying off.

Some launch tracks have more than 200 magnets in a row. Each one helps pull the train forward.

THINK LIKE A RIDE MECHANIC

You are a ride mechanic. Name two parts of the coaster you would check before the park opens.



Use the article to tell why each one matters.





LAST DROP TEST



Circle the best answer.

1 The first big climb on a coaster is the...

- ☐ **A** lift hill
- ☐ **B** loop
- ☐ **C** station
- ☐ **D** brake run

3 Wheels that roll on top of the rail are...

- ☐ **A** side wheels
- ☐ **B** upstop wheels
- ☐ **C** chain hooks
- ☐ **D** road wheels

5 Wheels under the rail that keep the car on are...

- ☐ **A** road wheels
- ☐ **B** upstop wheels
- ☐ **C** side wheels
- ☐ **D** steering wheels

2 The pull that brings things down toward Earth is...

- ☐ **A** friction
- ☐ **B** magnetism
- ☐ **C** gravity
- ☐ **D** speed

4 A lap bar or harness that holds a rider in is a...

- ☐ **A** safety sign
- ☐ **B** restraint
- ☐ **C** chain hook
- ☐ **D** brake fin

6 The catches that stop a train from rolling back down are the...

- ☐ **A** launch
- ☐ **B** restraints
- ☐ **C** magnetic brakes
- ☐ **D** anti-rollback



LAST DROP TEST

- 7** This coaster will launch. Launch means to...
- ☐ (A) stop slowly at the end
 - ☐ (B) roll backward
 - ☐ (C) fling forward fast
 - ☐ (D) climb on a chain
- 9** As the train dives down a hill, stored energy turns into...
- ☐ (A) motion energy
 - ☐ (B) cold water
 - ☐ (C) heavier riders
 - ☐ (D) a stronger chain
- 11** What happens if a restraint is not locked on many rides?
- ☐ (A) The ride goes slower.
 - ☐ (B) The rider must hold on tight.
 - ☐ (C) The train can't leave.
 - ☐ (D) The lights turn red.
- 8** The mechanic did an inspection. An inspection is...
- ☐ (A) a careful safety check
 - ☐ (B) a fun ride for workers
 - ☐ (C) a fresh coat of paint
 - ☐ (D) a ticket check at the gate
- 10** Why does the train slow down as it climbs the next hill?
- ☐ (A) The riders lean back.
 - ☐ (B) The magnets on the hill push the train back.
 - ☐ (C) The chain grabs it.
 - ☐ (D) Motion energy turns into stored energy.
- 12** Why do magnetic brakes need help from other brakes?
- ☐ (A) They are too loud.
 - ☐ (B) They can't hold a train still.
 - ☐ (C) They make the train go much faster.
 - ☐ (D) They only work when it rains.

Score: ____ / 12



ANSWER KEY

Read It Right (sidebars)

Page 1: D (the anti-rollback catches) Page 2: B (keep the car from lifting off) Page 3: C (magnetic brakes)

Climb the word hill

1. j 2. c 3. g 4. f 5. d 6. i 7. h 8. e 9. a 10. b

Fill the train

1. lift hill 2. anti-rollback 3. launch 4. gravity 5. restraint 6. upstop wheels 7. magnetic brakes 8. inspection

Sort the station (circle)

1. road wheels, side wheels, upstop wheels (not: steering wheel)
2. wheels, brakes, restraints (not: ticket prices)
3. never touch fins, slow the train, use metal fins (not: hold train still)
4. chain pulls train, catches drop in, clacking sound (not: brakes stop it)
5. restraints, sensors, anti-rollback (not: first drop)

Think Like a Ride Mechanic (sample)

Any two, with a reason from the article: the upstop wheels, because they keep the car from lifting off the track on hills and loops; the road and side wheels, because they carry the weight and steer through curves; the brakes, because the train has to stop at the end; the restraints, because they hold riders in (and the train can't leave if one is not locked); the anti-rollback catches, because they keep the train from rolling back if the chain stops; the track itself.

Last drop test

1. A 2. C 3. D 4. B 5. B 6. D 7. C 8. A 9. A 10. D 11. C 12. B

Sources

Coaster101, Coasters-101: Lift Hills; Wikipedia, Lift hill and Chain lift (chain lifts; anti-rollback dogs drop into a ratchet strip and make the clacking sound; they stop a rollback if the chain fails).

Wikipedia, Launched roller coaster and Launch track (launches use linear motors, hydraulics or other systems instead of a lift hill; LIM/LSM tracks often have more than 200 motors; many launch to high speed in seconds).

HowStuffWorks, Roller Coaster Physics; Wikipedia, Physics of roller coasters (potential energy at the top turns into kinetic energy on drops and back again on climbs; friction and air take energy, so later hills are lower).

Wikipedia, Roller coaster wheel assembly; Coasterpedia, Wheel assembly; Britannica (road wheels on top, side-friction wheels on the side, upstop wheels under the rail; John A. Miller patented the underfriction/upstop wheel in 1919).

Wikipedia, Brake (roller coaster) and Eddy current brake (copper or aluminum fins pass between permanent magnets; no contact; works without power; cannot hold a train still, so other brakes are needed).

Theme-park safety explainers and restraint patents (redundant locks on restraints; ride control systems check that every restraint is locked before dispatch).

ASTM F770 (daily pre-opening inspections and unloaded test cycles for amusement rides); ride mechanic job postings (daily inspections, maintenance, repair).

U.S. Bureau of Labor Statistics, Occupational Outlook Handbook: General Maintenance and Repair Workers (median pay May 2025: \$49,590 a year). BLS has no separate pay figure for ride mechanics.

Wikipedia, Switchback Railway; ASCE Civil Engineering Almanac (LaMarcus Thompson's Switchback Railway opened at Coney Island in 1884; about 6 mph; 5 cents a ride).



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