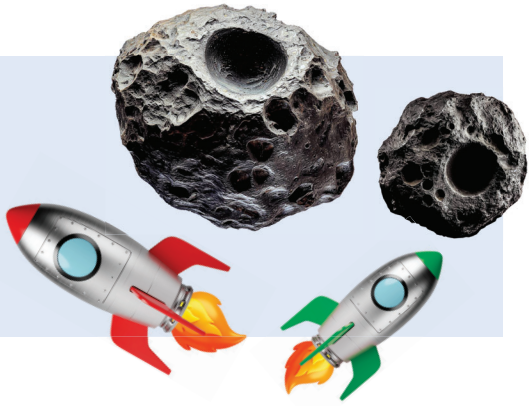
ROCKET SCIENCE

Consider how objects will accelerate when multiple forces act on them.

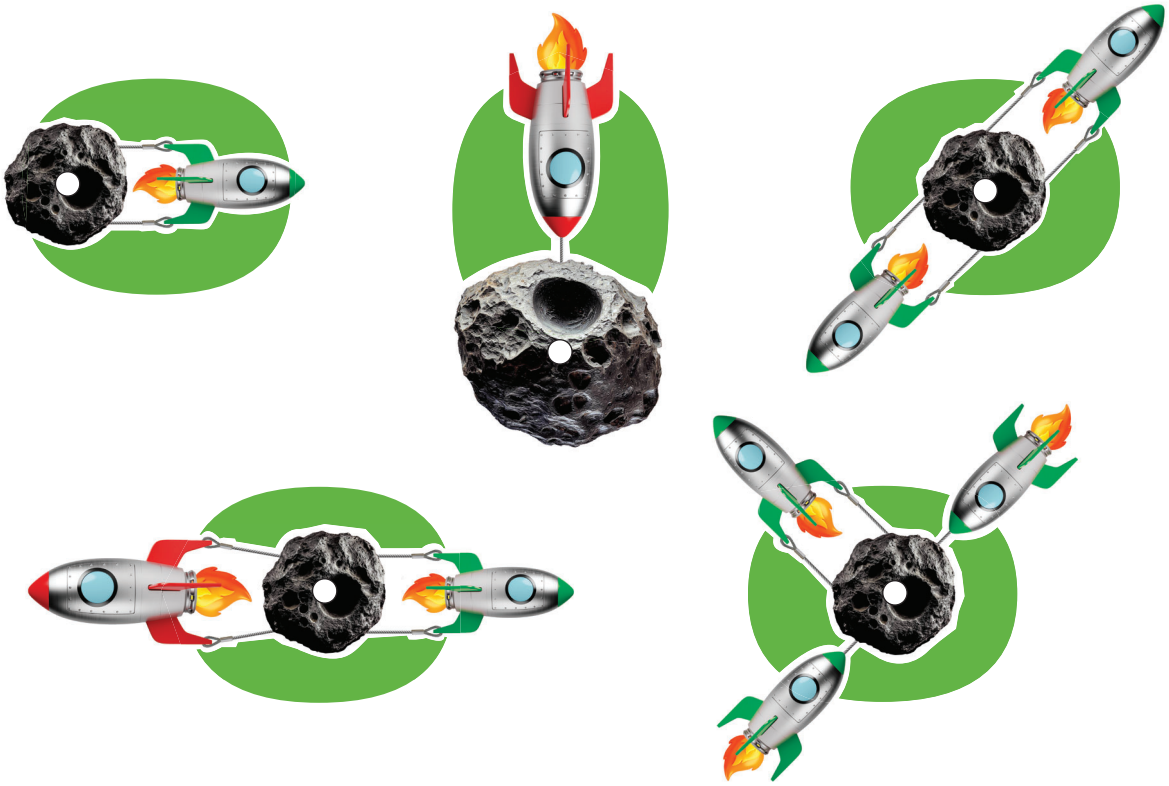
PRACTICE:

In the problems below, big rockets and small rockets are attached to big asteroids and small asteroids in space.

Big rockets pull harder than small ones, and big asteroids have more mass than small ones.



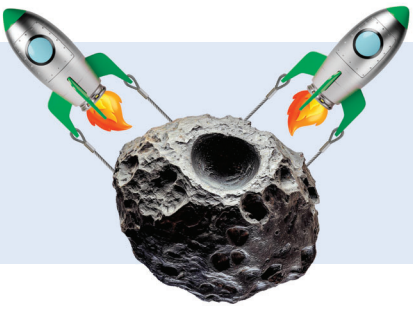
15 Draw an arrow from the dot in the middle of each asteroid below to show which way it will accelerate. Circle any asteroids that won't accelerate.



DISCUSSION:

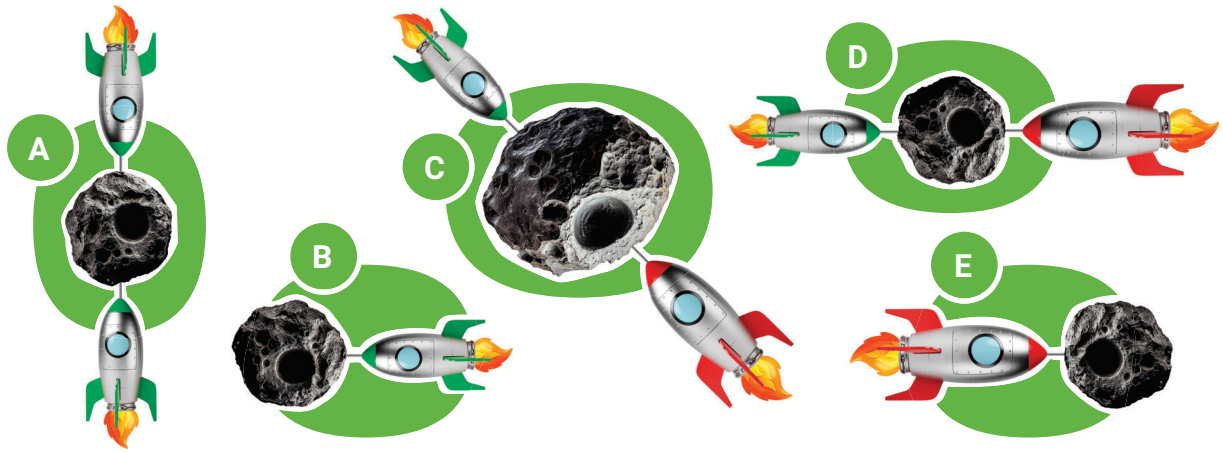
16 What direction do you think this asteroid will accelerate?

Explain.

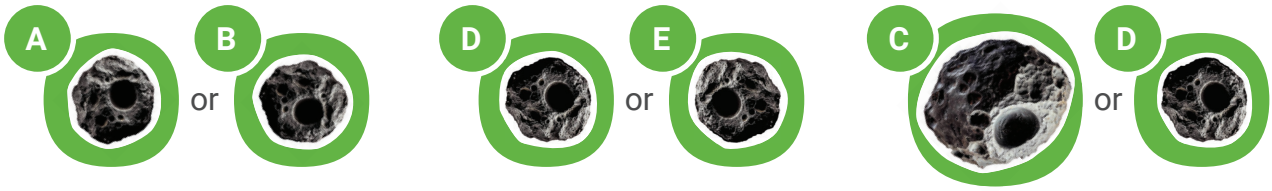


PRACTICE:

Use the asteroids below to answer the questions that follow.

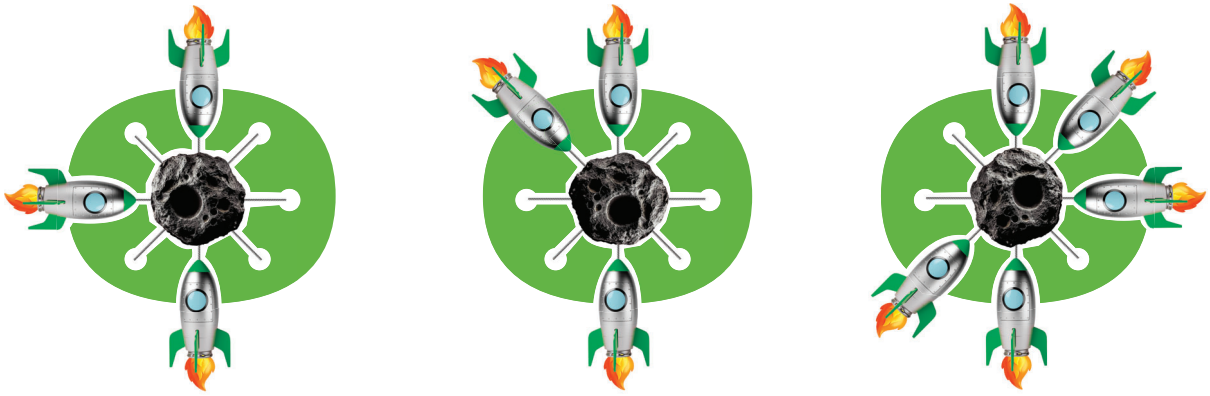


17 For each pair below, circle the asteroid that will have greater acceleration.



18 Which of the asteroids above (A, B, C, D, or E) will not accelerate? Explain.

19 For each asteroid below, draw a dot on the rod where you would attach a small rocket to prevent the asteroid from accelerating.



FRICTION

The law of inertia states that objects in motion tend to stay in motion. But on Earth, objects always seem to stop on their own. Why?

Friction! Friction resists the motion between objects that are sliding (or trying to slide) past each other.

DISCUSSION:

20 It's hard to imagine a world without friction. Everything would be impossibly slippery.

Which of these three vases would be easiest to pick up in a world without friction? Which would be hardest? Explain.

21 Turn to the previous page and then turn back again. Do you think turning pages in a book would be easier or harder without friction? Explain.

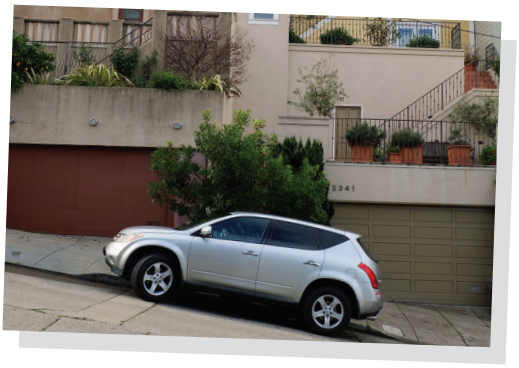
22 Describe one reason it would be *harder* to open a jar in a world without friction.

23 Describe one reason it would be *easier* to open a jar in a world without friction.

BALANCING FRICTION

Friction often works against other forces that are pushing or pulling an object.

24 Friction, gravity, and support force are all at work on this parked car. Are the forces balanced? How can you tell?



25 This skier is not accelerating. If they hit an icy patch and the friction between their skis and the snow is suddenly reduced, what do you expect to happen? Explain.

26 Nia is pushing her brother around in a box. Would it be easier or harder for Nia to push the box if she were wearing socks? Explain.

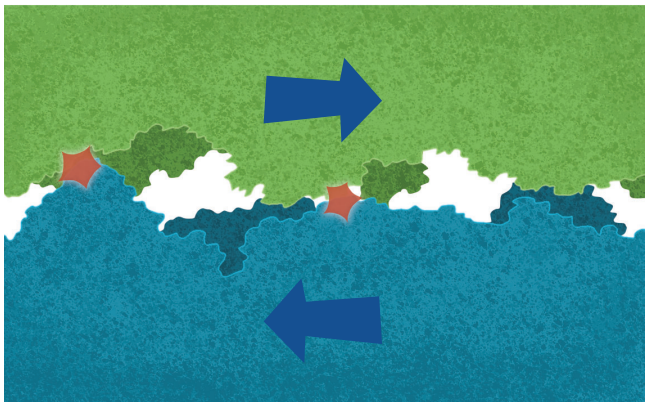
WEIGHT AND FRICTION

If you could zoom in on everyday objects, you would see that even surfaces that look smooth actually have lots of dents, lumps, and bumps that create friction.

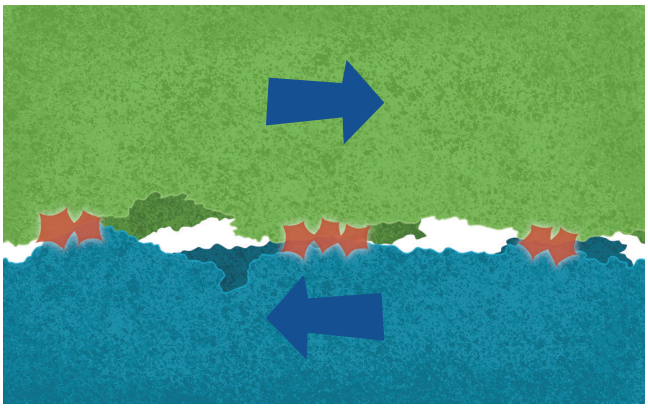
When you press surfaces together, they squish and touch at more places, creating more of the 'sticky' spots. So, the amount of friction between two objects depends on how hard they are pressed together.

Heavy objects press against the surfaces below them more than light objects.

Less Weight



More Weight



PRACTICE:

Stand in socks on a smooth floor with your feet shoulder-width apart to try these challenges.

27 Balance your weight on both feet equally. Try to slowly slide them apart. Can you slide both feet at the same time?

- Easily!
- Usually.
- Impossible!

28 Lean left so that most of your weight is on your left foot. Try to slowly slide your feet apart. Can you slide both feet at the same time?

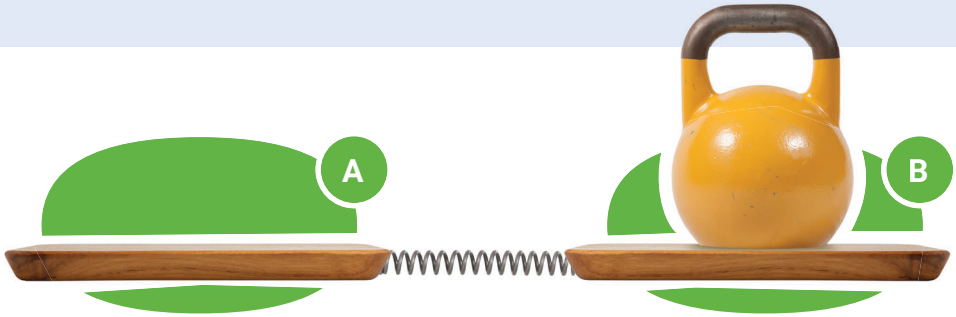
- Easily!
- Usually.
- Impossible!

29 Keep most of your weight on your left foot. Which foot is easier to slide across the floor?

- Left foot.
- Right foot.
- They're equal.

PRACTICE:

The identical trays below are connected by a spring, with a weight on one tray.



30 Which tray is easier to slide: A or B? Explain.

31 What will stretch the spring more: pulling tray A to the left or tray B to the right? Explain.

32 What will squeeze the spring more: pushing A to the right or B to the left? Explain.

JOURNAL:

33 Rest a meter stick or similar object on top of your index fingers as shown below. Slowly slide your fingers toward each other. Describe in your journal how your fingers slide. Do they slide at the same time, or take turns? Can you choose which finger slides? If you place one finger near an end and one near the middle, which finger slides?

How does friction explain what is happening?