

The weight lifter applies a large force to hold the barbell over his head.

Because the barbell is-

DOK question:

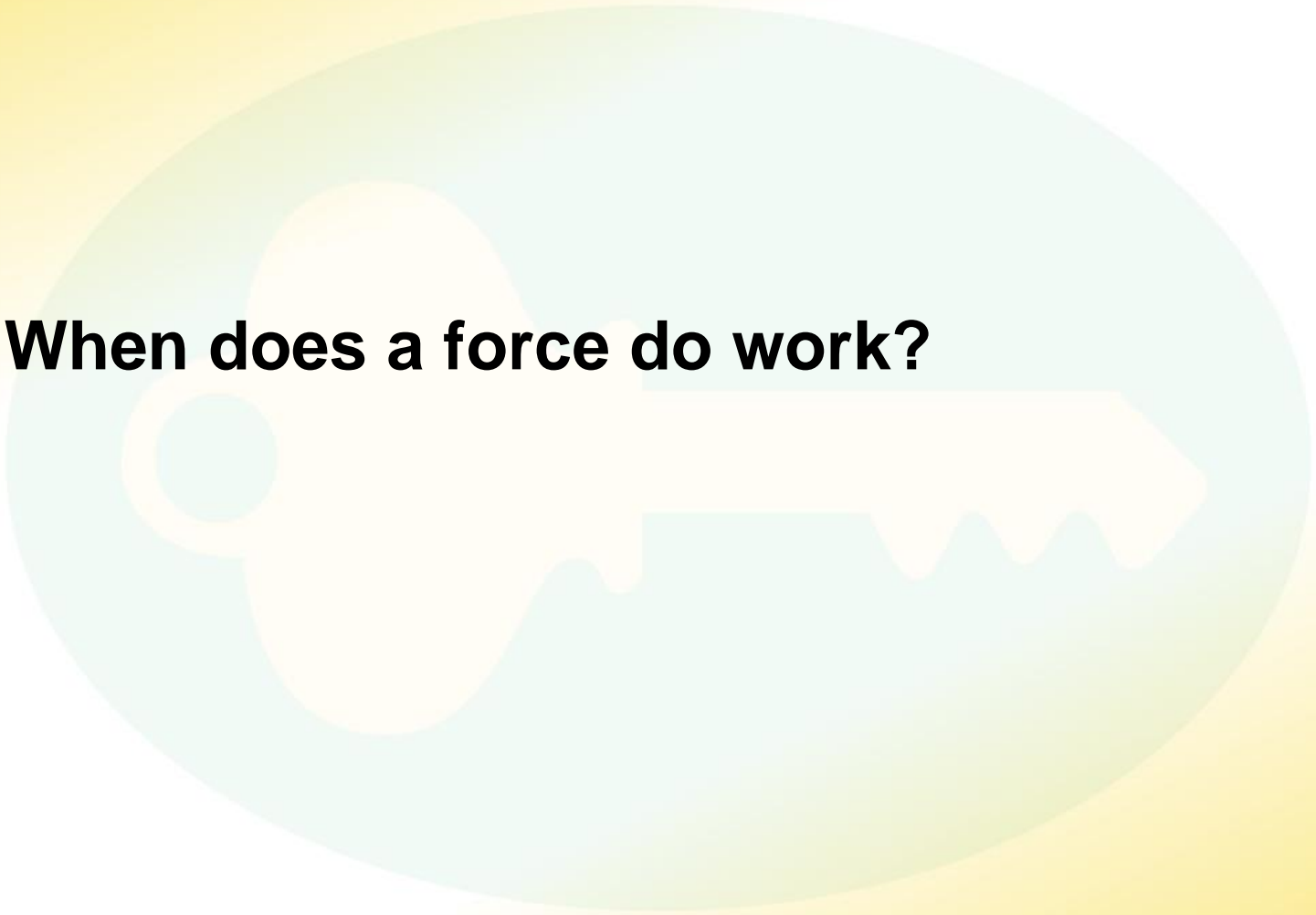
Construct a visual representation of what is happening here.



What Is Work?



When does a force do work?



What Is Work?



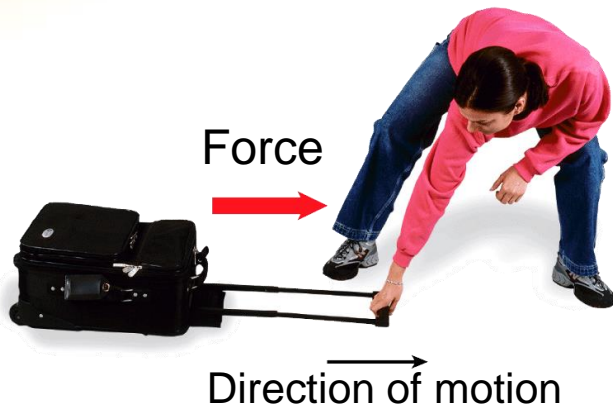
For a force to do work on an object, some of the force-



Any part of a force-

What Is Work?

- A. -
- B. -
- C. -



A Force and motion in the same direction



This force does work
This force does no work
B Part of force in direction of motion



C Lifting force not in direction of motion

Calculating Work

Work

$$\text{Work} = \text{Force} \times \text{Distance}$$

Calculating Work

Units of Work

When using SI units in the work formula, the force is in newtons, and distance is in meters.

The **joule (J)** is-

DOK question:

Construct another example of combining units utilizing previous units (m, s, or s^2).

Calculating Work

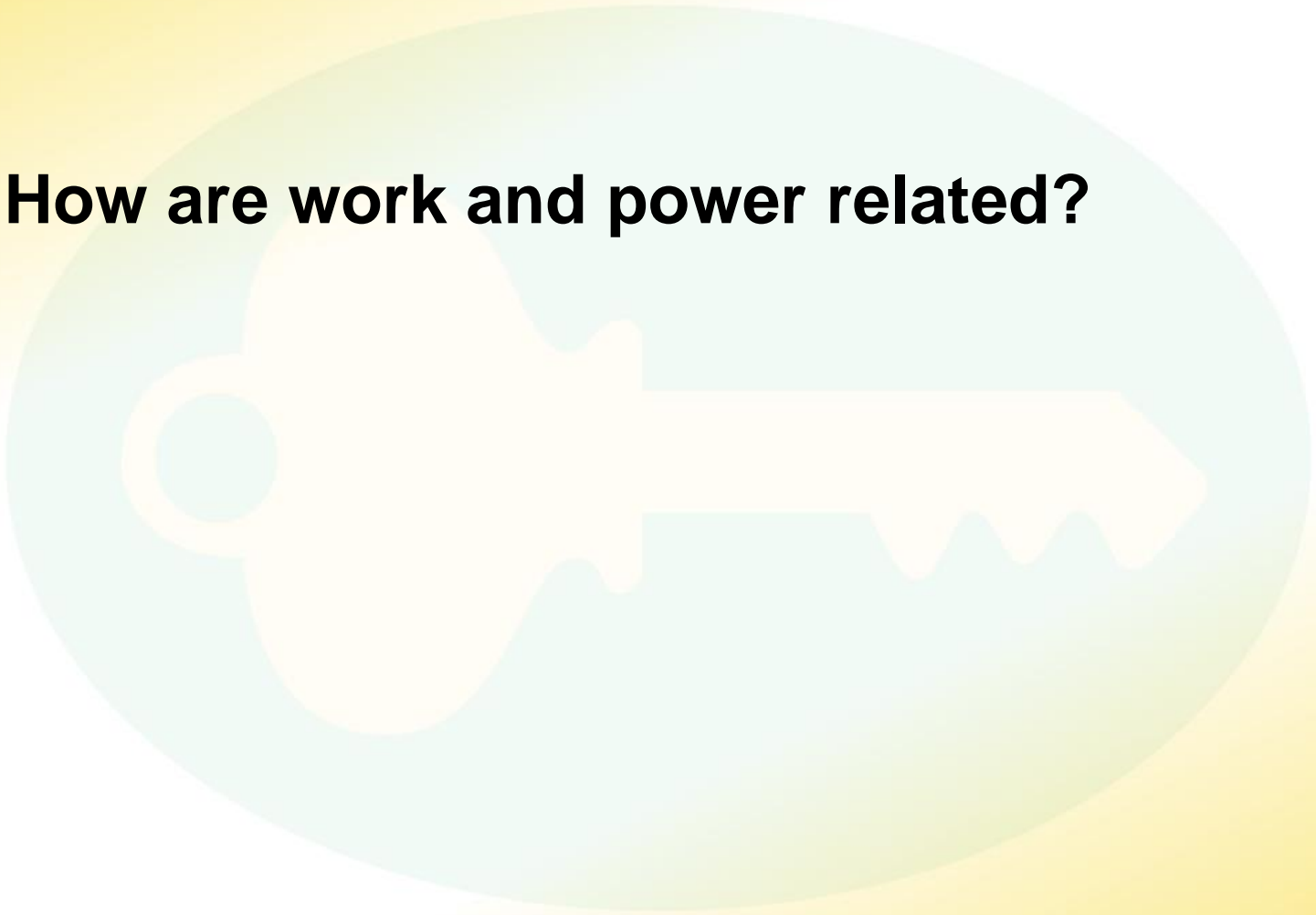
Using the Work Formula

A weight lifter raises a 1600-newton barbell to a height of 2.0 meters.

What Is Power?



How are work and power related?



Calculating Power

Power

$$\text{Power} = \frac{\text{Work}}{\text{Time}}$$

Calculating Power

When using SI units in the power formula, work is measured in joules (J), and time is measured in seconds (s).

The SI unit of power is –

DOK question:

Construct another example of combining units utilizing previous units (m, s, or s^2).

Calculating Power

Math Practice

1. Your family is moving to a new apartment. While lifting a box 1.5 m straight up to put it on a truck, you exert an upward force of 200 N for 1.0 s. How much power is required to do this?

Calculating Power

Math Practice

2. You lift a book from the floor to a bookshelf 1.0 m above the ground. How much power is used if the upward force is 15.0 N and you do the work in 2.0 s?

Calculating Power

Math Practice

3. You apply a horizontal force of 10.0 N to pull a wheeled suitcase at a constant speed of 0.5 m/s across flat ground. How much power is used? (*Hint:* The suitcase moves 0.5 m/s. Consider how much work the force does each second and how work is related to power.)

James Watt and Horsepower

Another common unit of power is the horsepower. One **horsepower** (hp) is –

Assessment Questions

1. In which of the following cases is work being done on an object?
 - a. pushing against a locked door
 - b. suspending a heavy weight with a strong chain
 - c. pulling a trailer up a hill
 - d. carrying a box down a corridor

Assessment Questions

2. A tractor exerts a force of 20,000 newtons to move a trailer 8 meters. How much work was done on the trailer?
- a. 2,500 J
 - b. 4,000 J
 - c. 20,000 J
 - d. 160,000 J

Assessment Questions

3. A car exerts a force of 500 newtons to pull a boat 100 meters in 10 seconds. How much power does the car use?
- a. 5000 W
 - b. 6000 W
 - c. 50 W
 - d. 1000 W

Assessment Questions

4. One horsepower is a unit of power equal to
- a. 0.746 W.
 - b. 1.0 W.
 - c. 746 W.
 - d. 2,000 W.