Force and Motion

Balanced and Unbalanced Forces

Fill in the blanks below:

- Two forces are balanced when they are equal in size but act in opposite directions.
- When the forces on an object are balanced, it will move at constant speed in one direction or remain at rest.
- When the forces on an object are unbalanced it will speed up (accelerate), slow down (decelerate) *or* change direction.

Vocabulary

- **Resistance** - A force that prevents or slows down motion.
- **Drag** – A force that opposes or slows a body's movement through air or water.
- **Friction** – The resistance to movement that occurs when two objects are in contact.
- **Thrust** – The force that causes an object to move forward
- **Turbulence** – Movement in irregular or unsteady patterns

Balanced and Unbalanced Forces

What you need to know:

What are balanced forces and how do they affect objects?

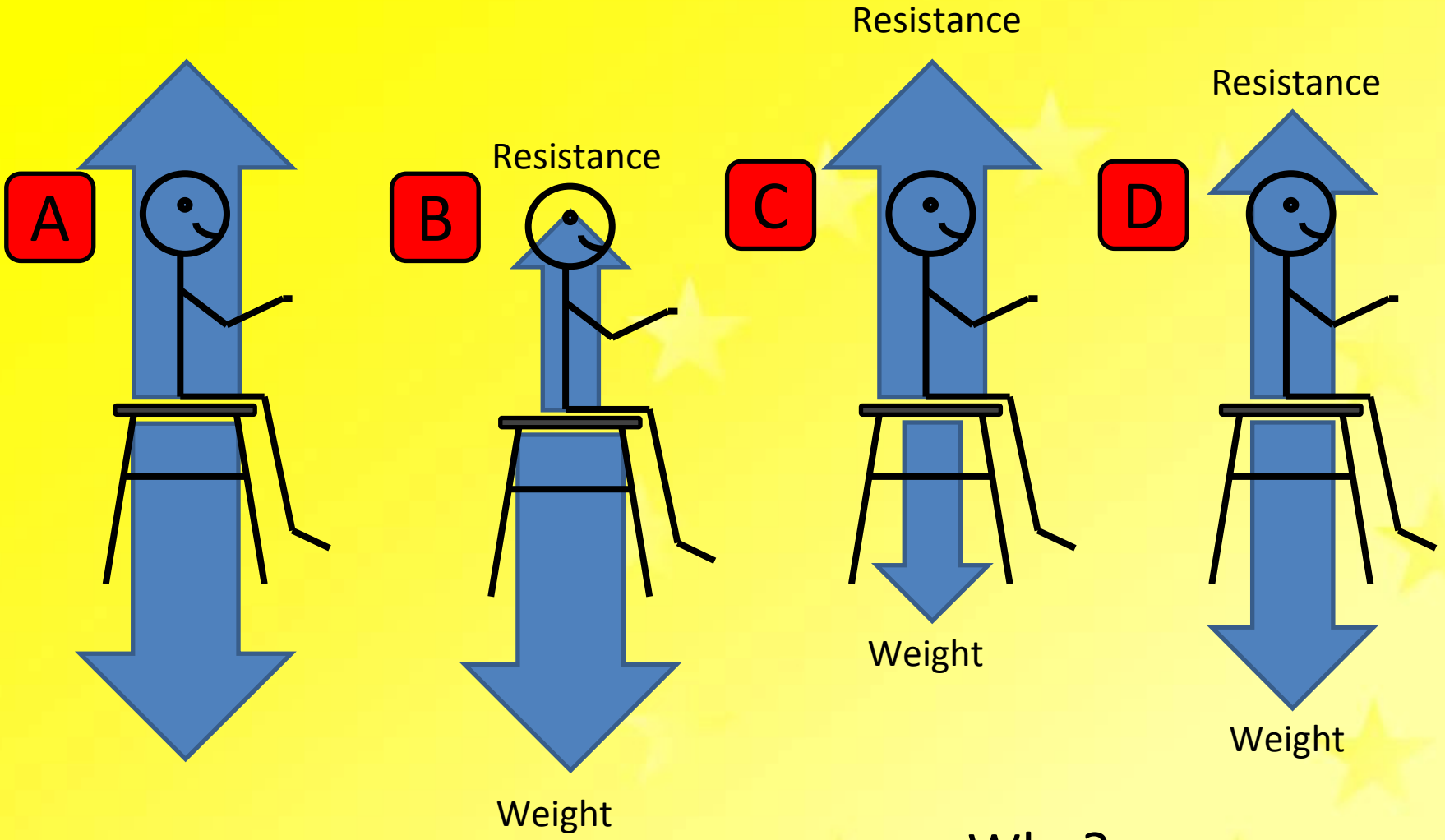
How do unbalanced forces affect objects?

How can we show the forces acting on an object?

To Do:

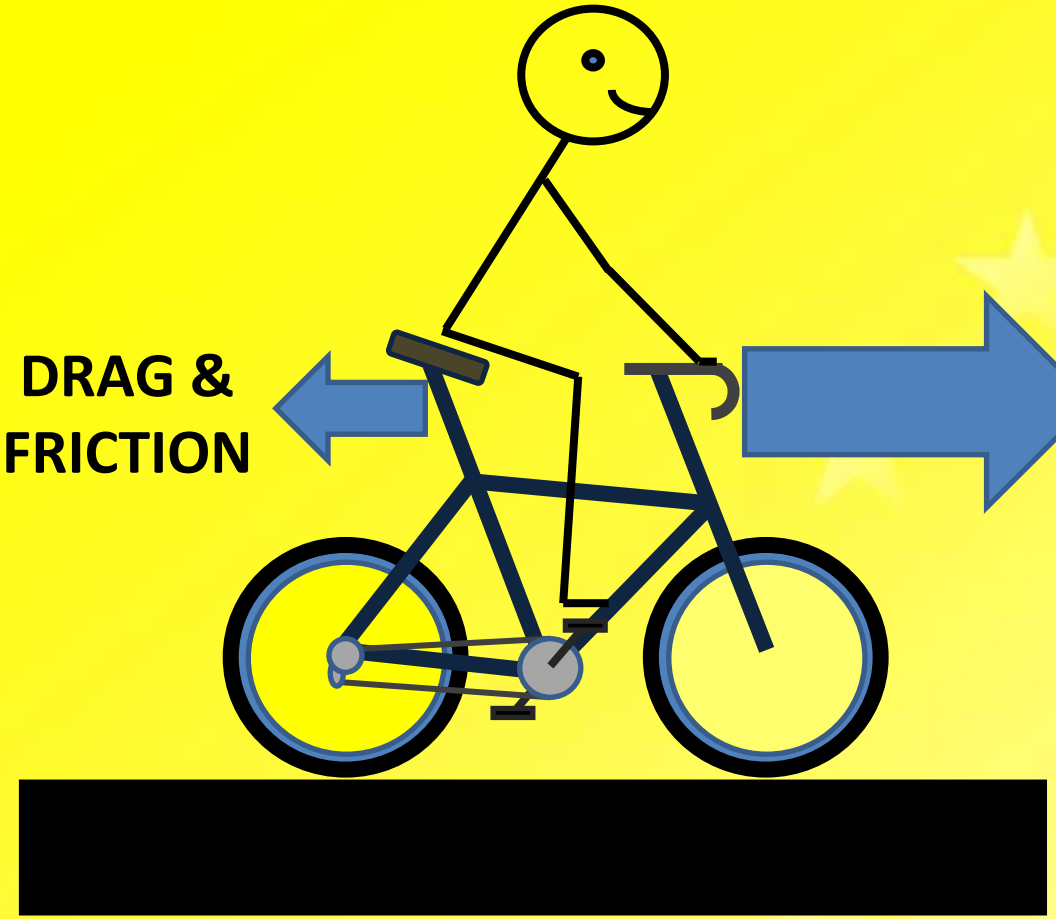
- Draw a diagram showing the forces on somebody sitting on a lab stool

Which diagram is correct?



Why?

What is the bicycle doing?



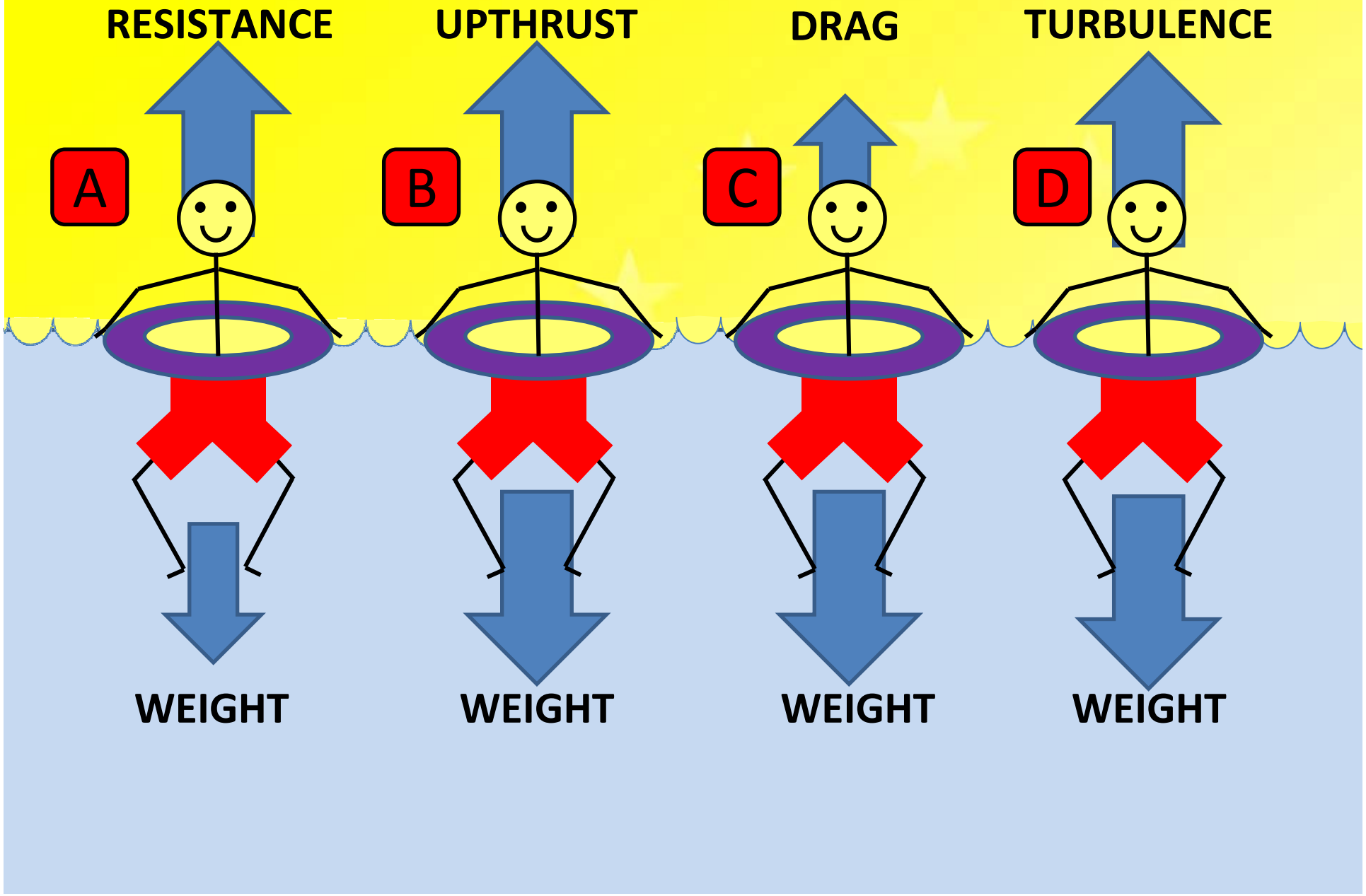
A Not moving

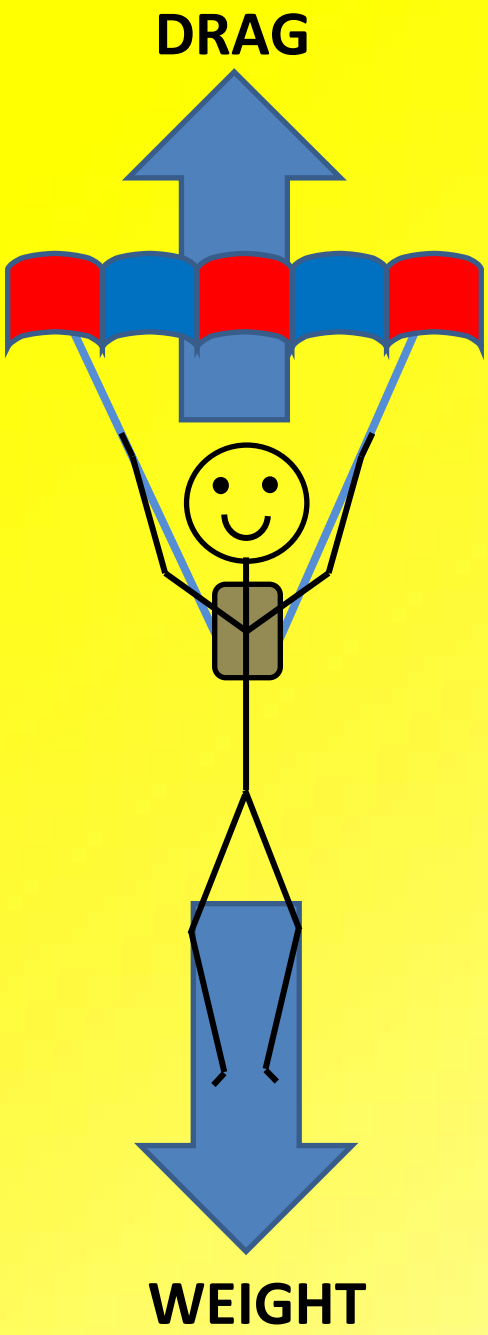
B Slowing down

C Speeding up

D Moving at constant speed

If the swimmer is floating, which diagram is correct?





What is the parachutist doing?

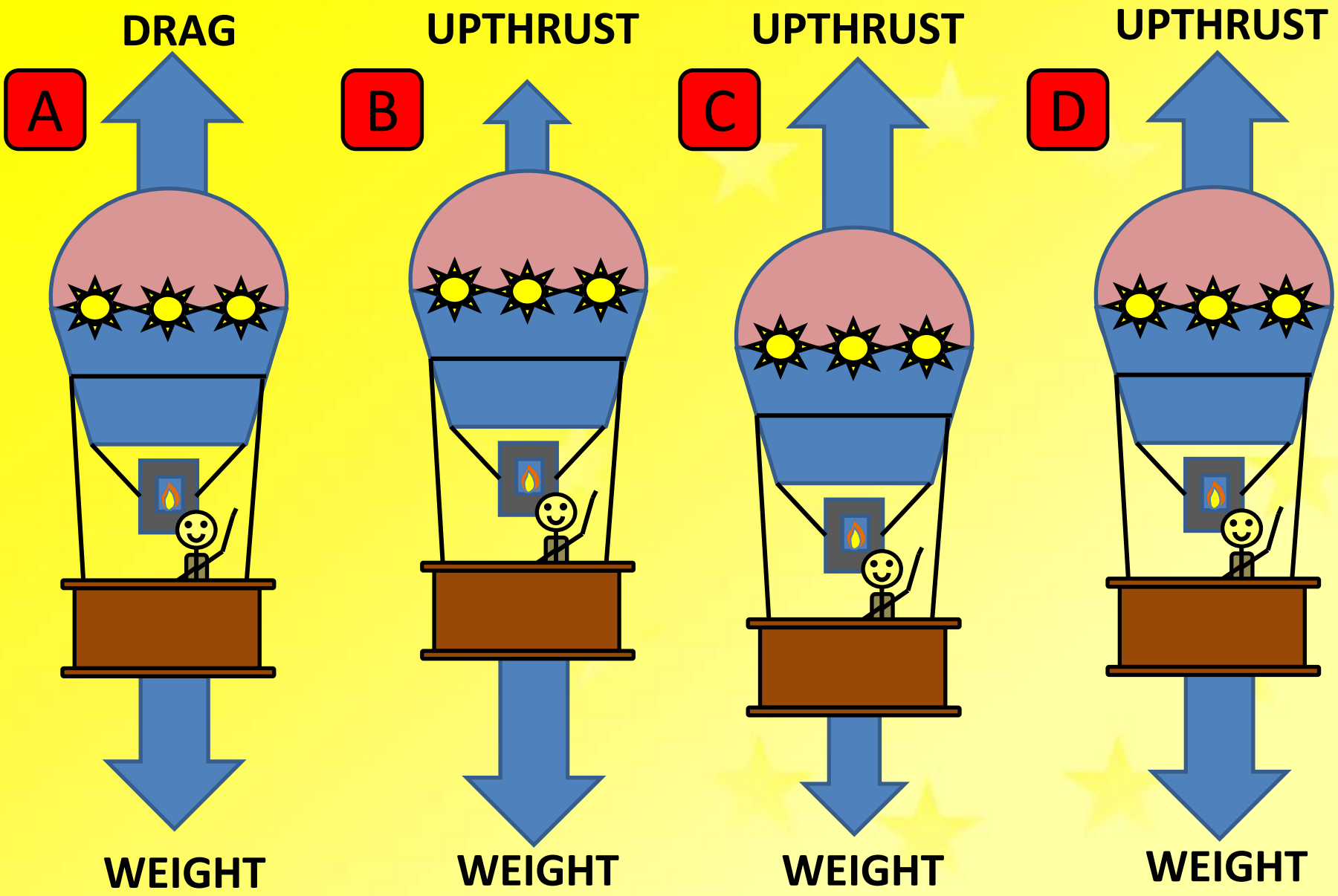
A Hovering in the air

B Falling at constant speed

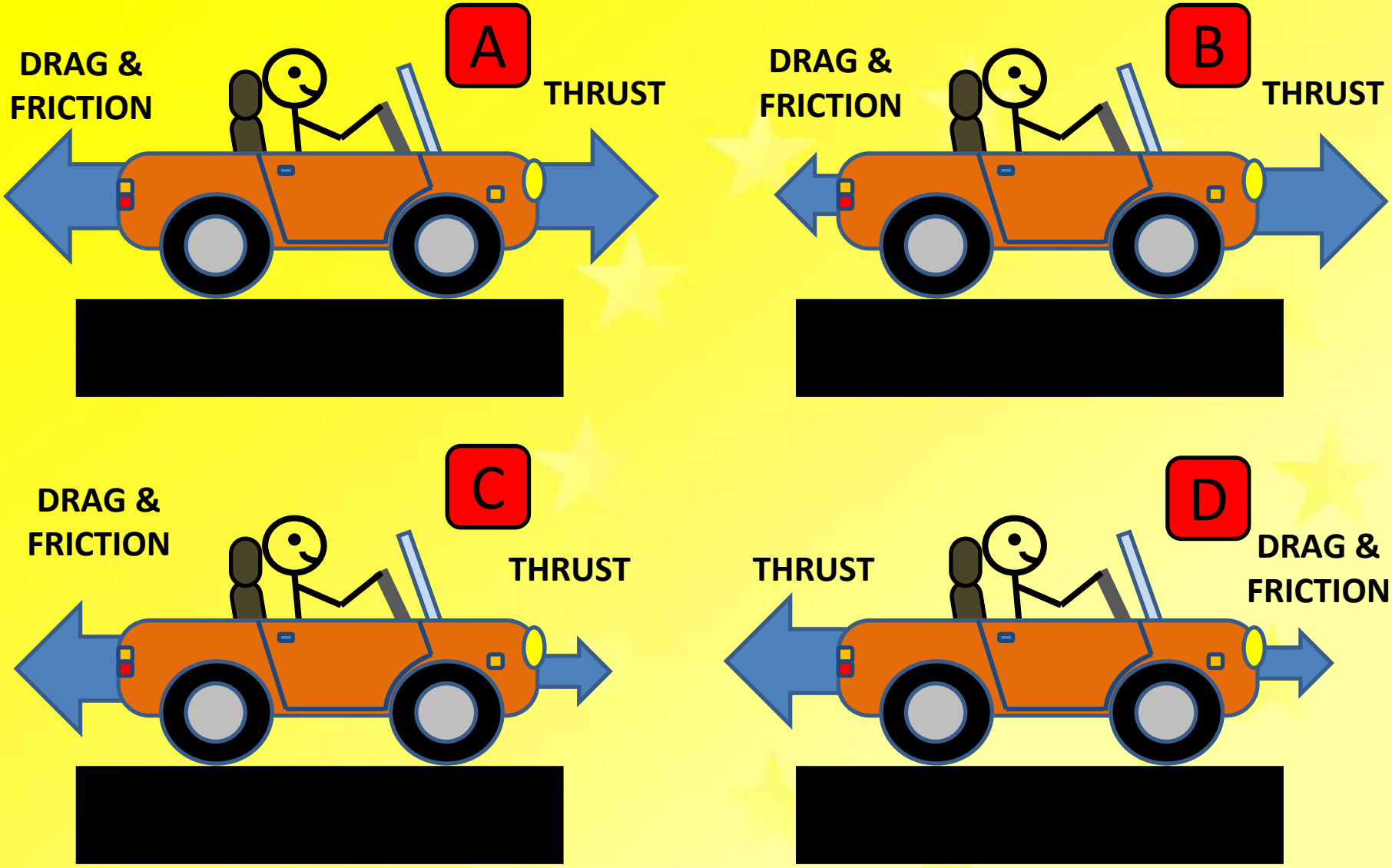
C Slowing down

D Speeding up (plunging to a horrible death)

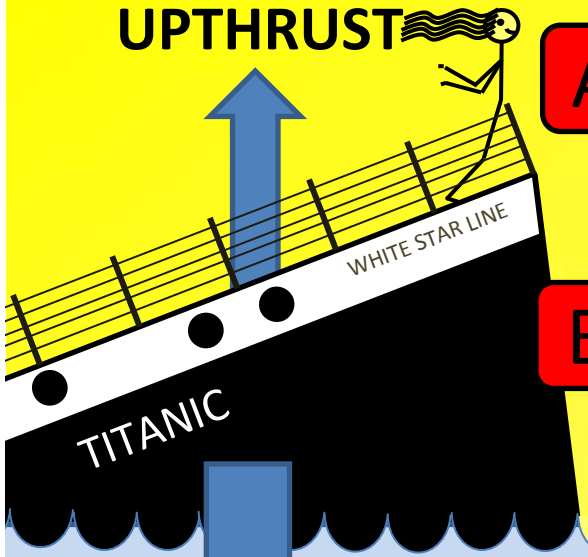
Which diagram shows a balloon floating at a constant height?



Which car is slowing down?



Which statement is *not* correct?

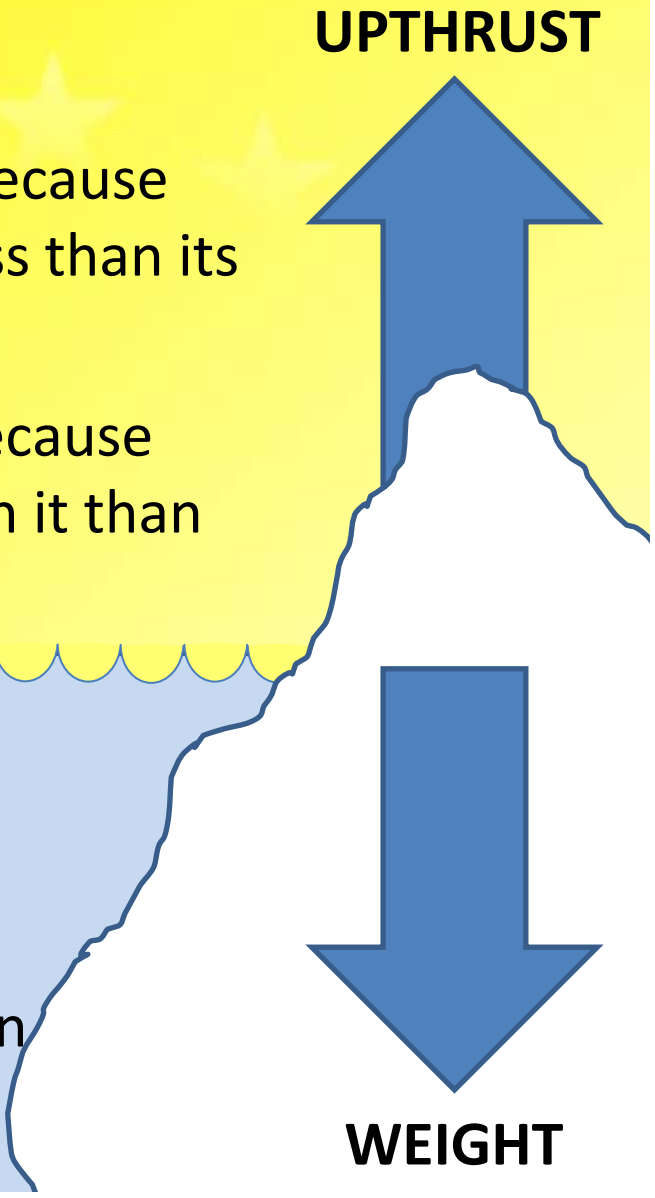


A The Titanic is sinking because the upthrust on it is less than its weight

B The Titanic is sinking because there is less upthrust on it than there is on the iceberg

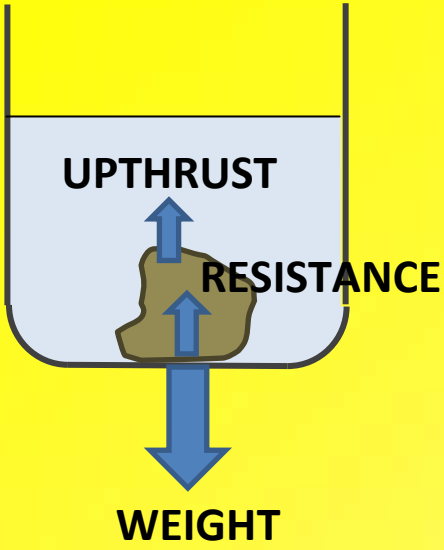
C The Titanic weighs less than the iceberg

D The iceberg is floating because the upthrust on it is equal to its weight

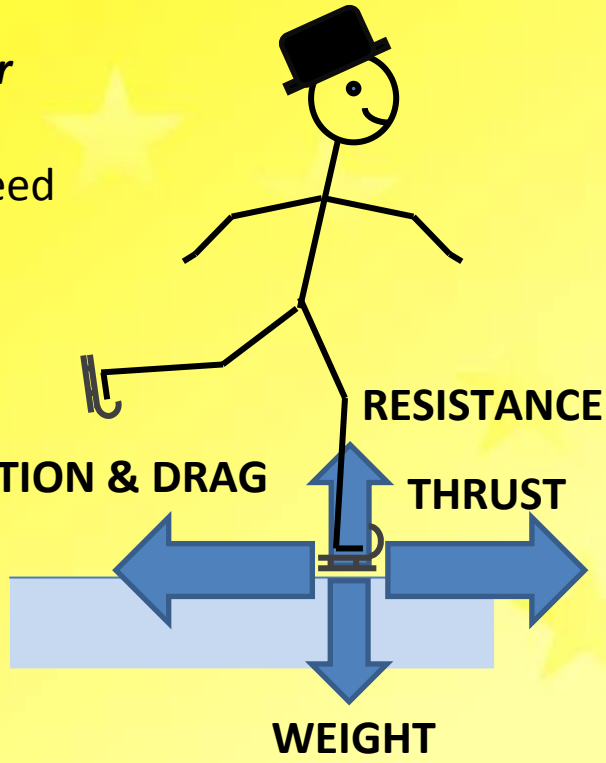


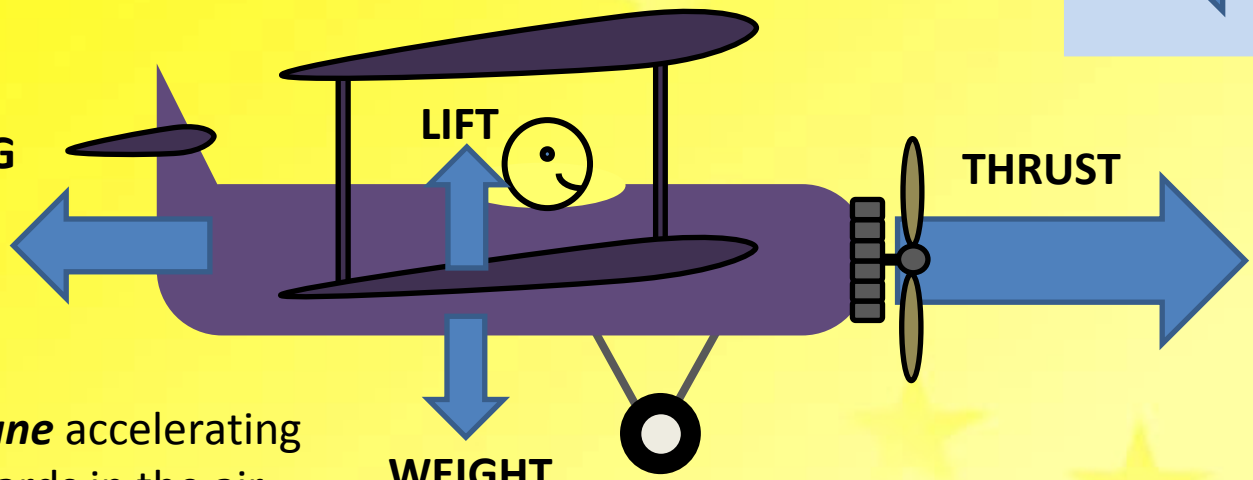
Add arrows to show ALL the forces acting on the object indicated.

A ***stone*** in a beaker of water



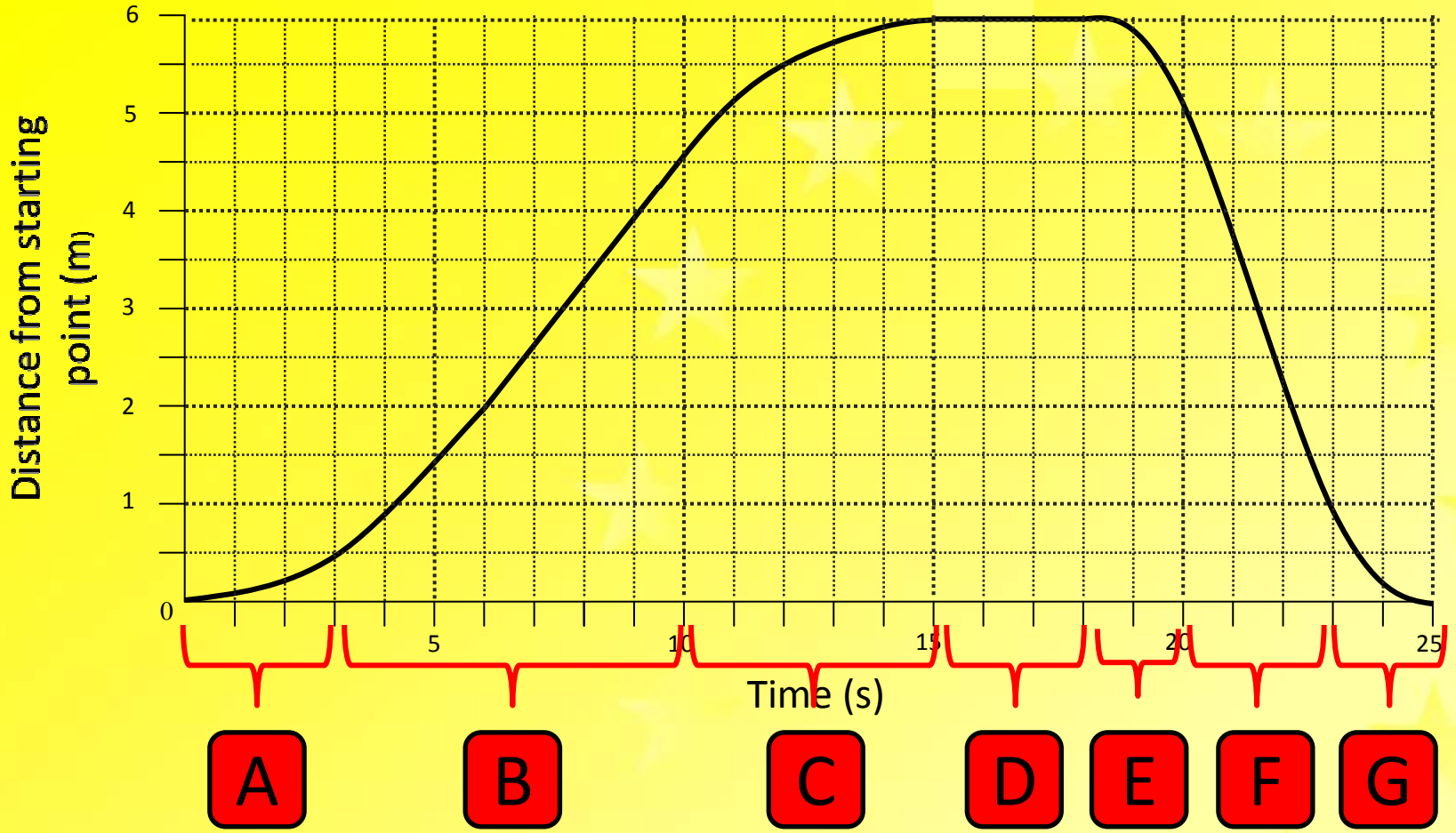
An ***ice skater*** moving at constant speed





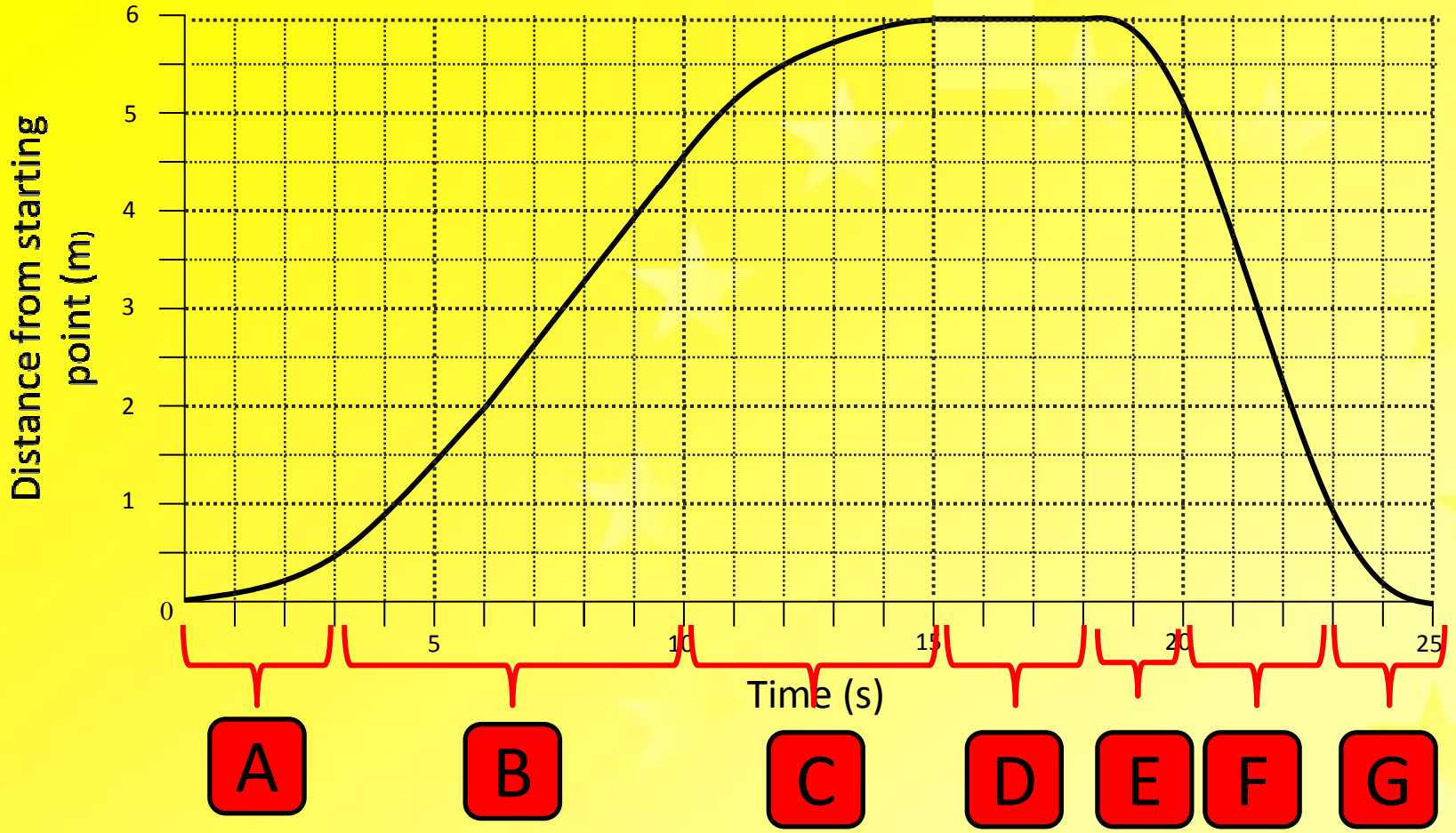
A ***plane*** accelerating forwards in the air

1. When was the car *moving* at constant speed?



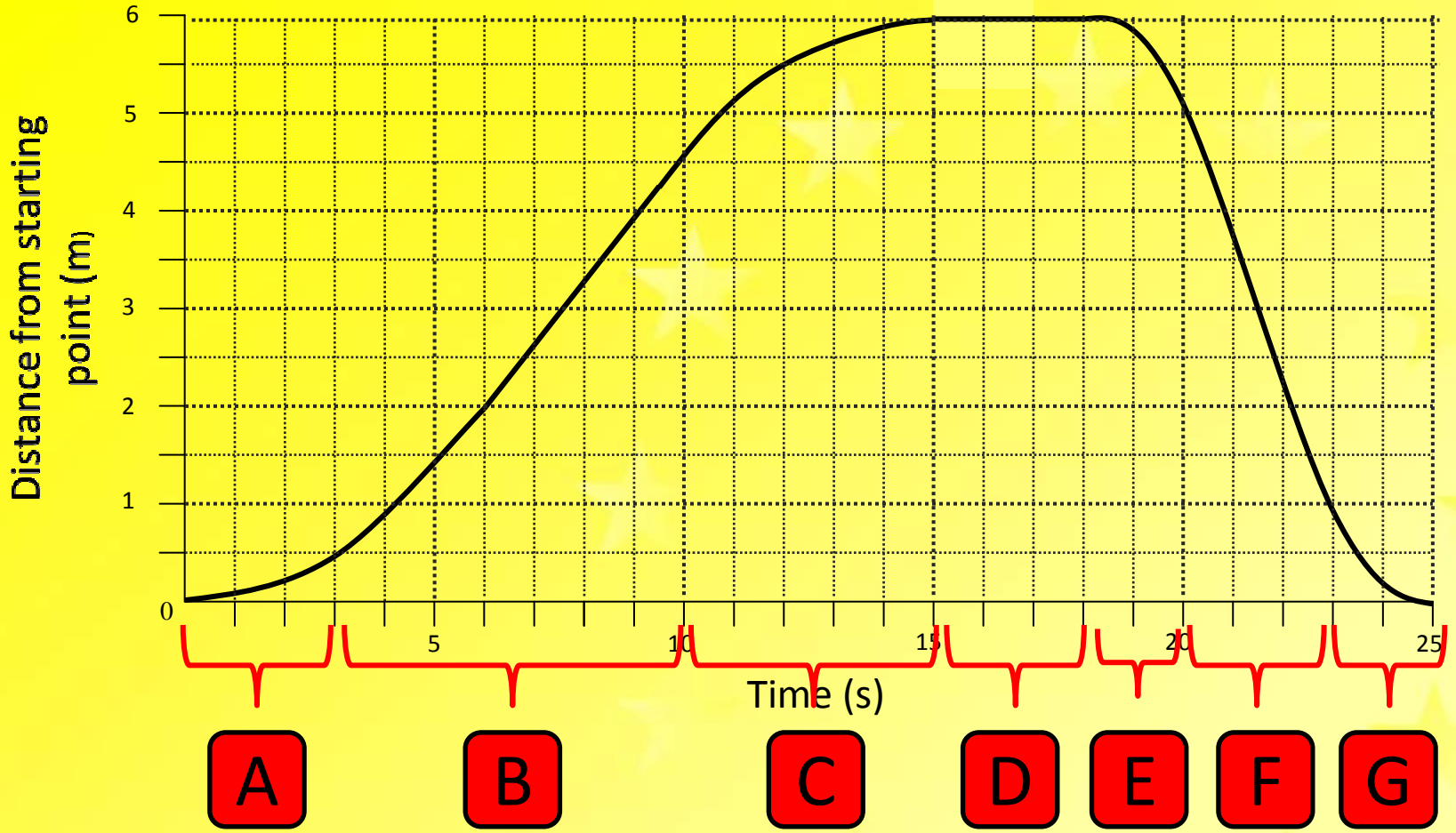
4s to 10s and 20s to 23s

2. When was the car speeding up?



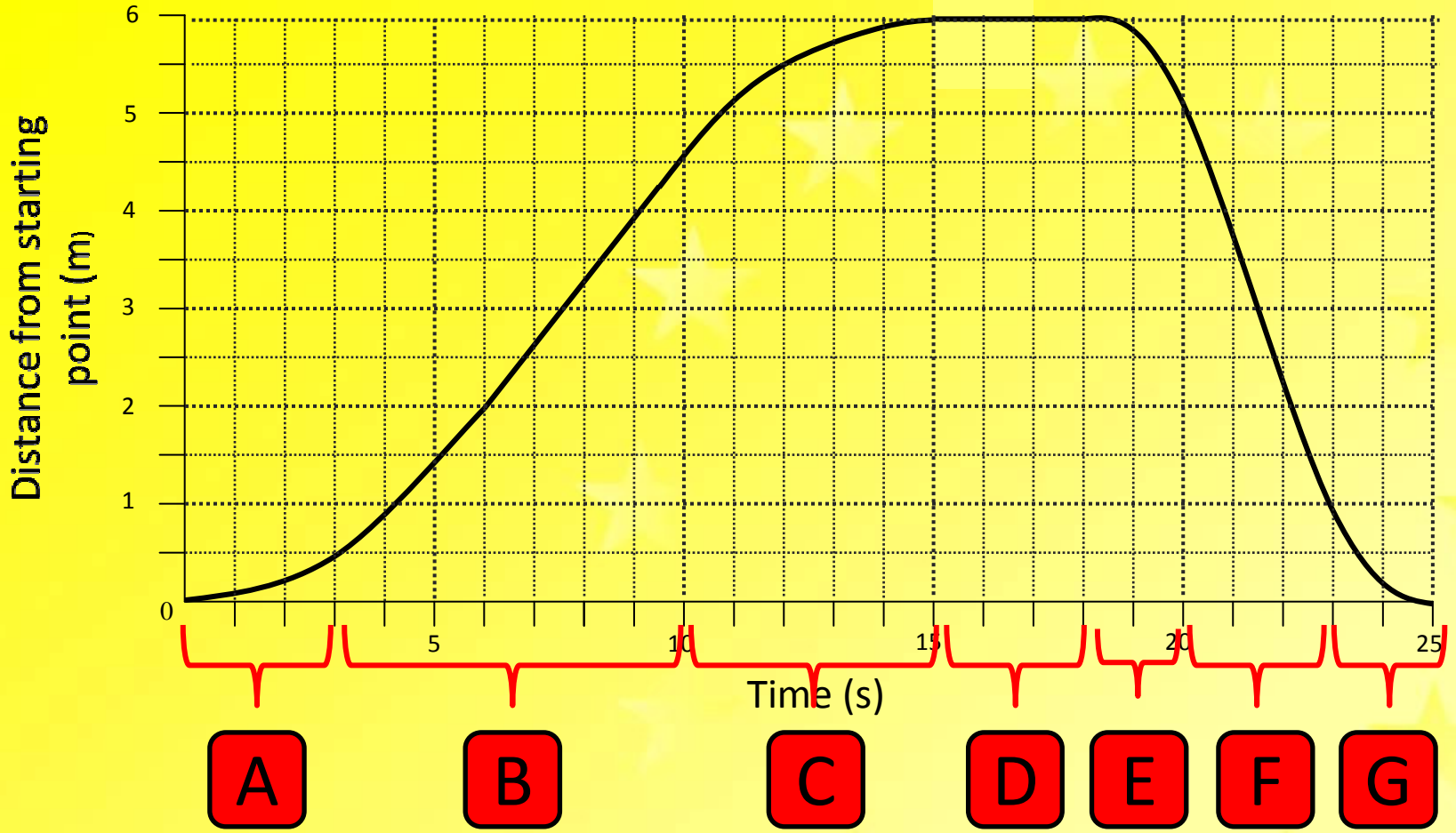
0s to 4s and 18s to 20s

3. When was the car stationary?



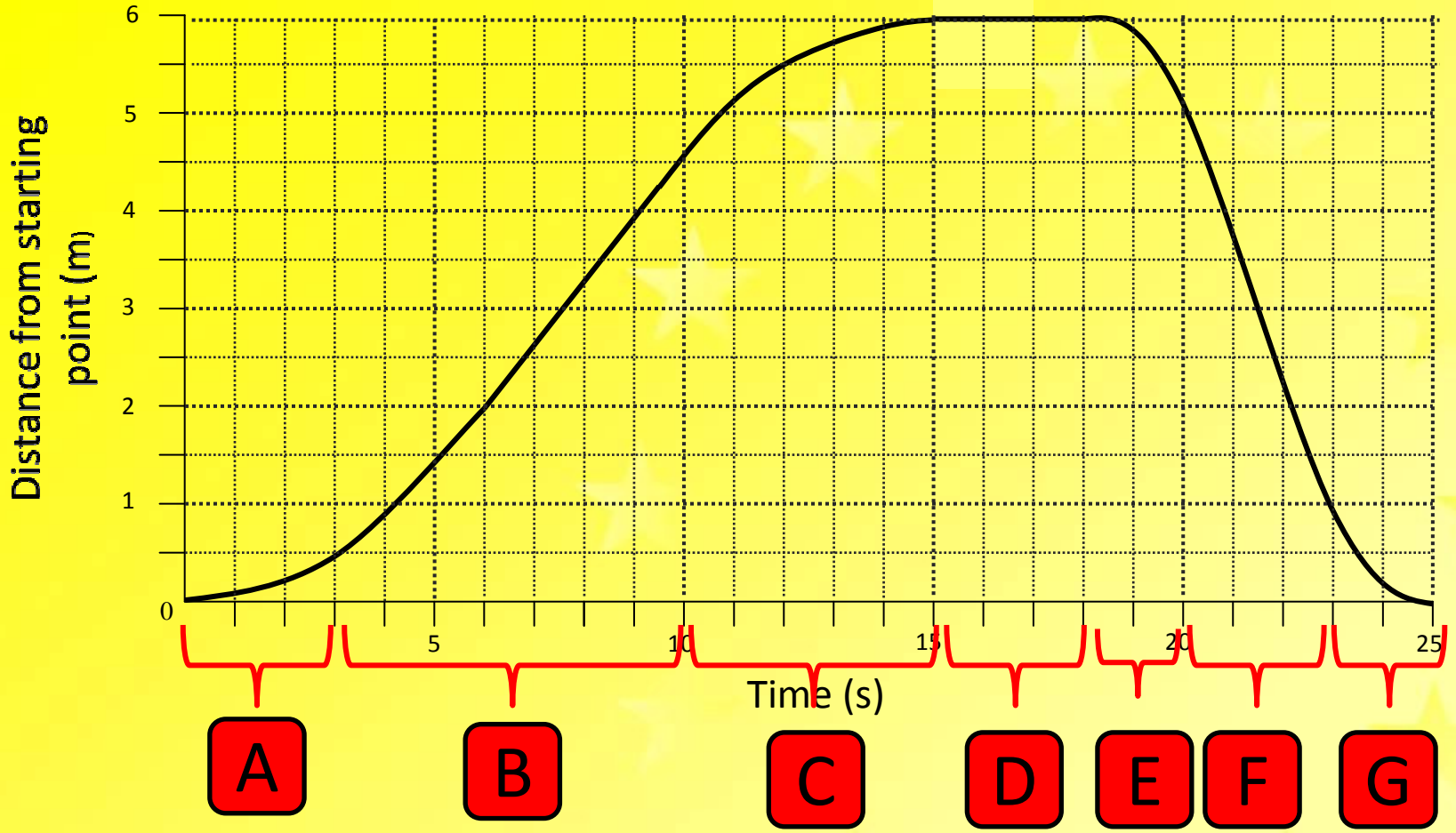
15s to 18s

4. When were the forces on the car balanced?



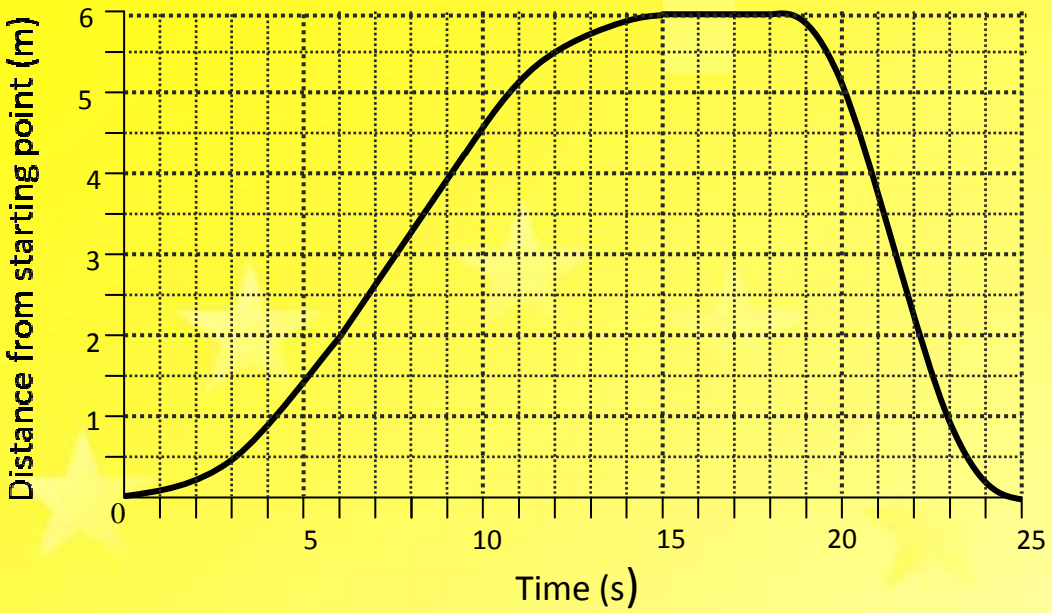
4s to 10s, 15s to 18s and 20s to 23s

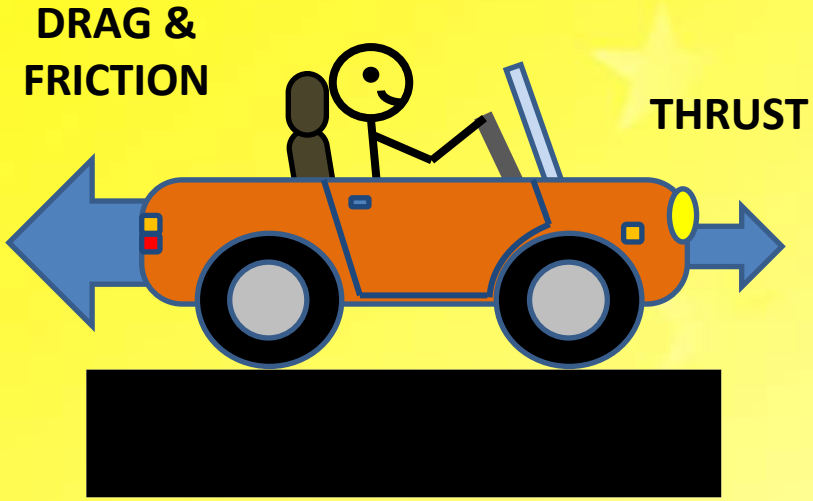
5. When was the thrust on the car greater than the drag acting on it?



0s to 4s and 18s to 20s (When it was accelerating)

6. Draw a diagram of the forces acting on the car at time = 24s

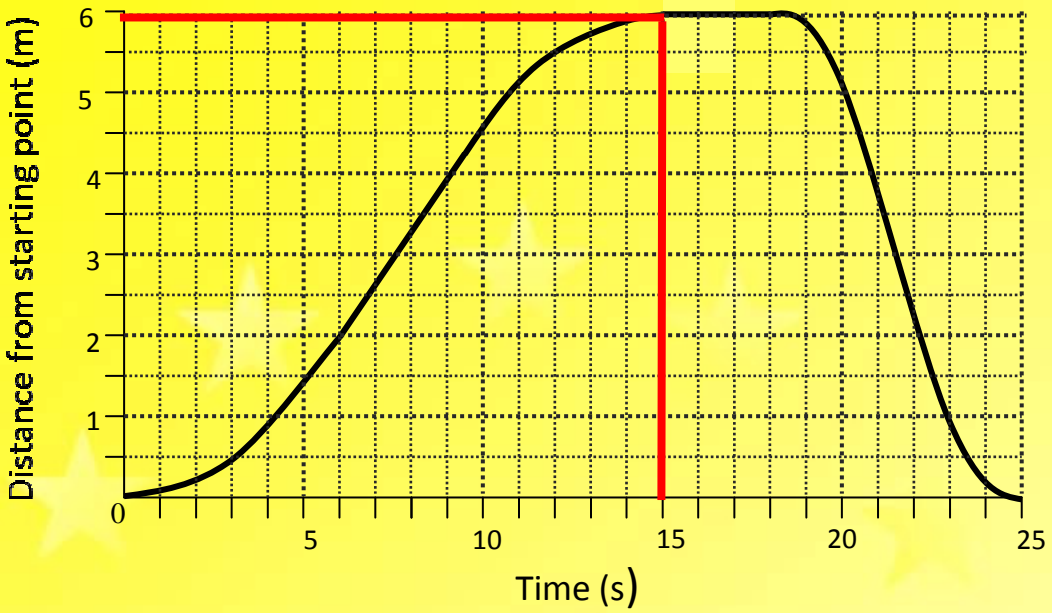




What is the car doing at this point?

Slowing down

7. What is the average speed between 0s and 15s?



$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} \qquad \text{Speed} = \frac{6}{15} = 0.40 \text{ m/s}$$

Time = 15 s

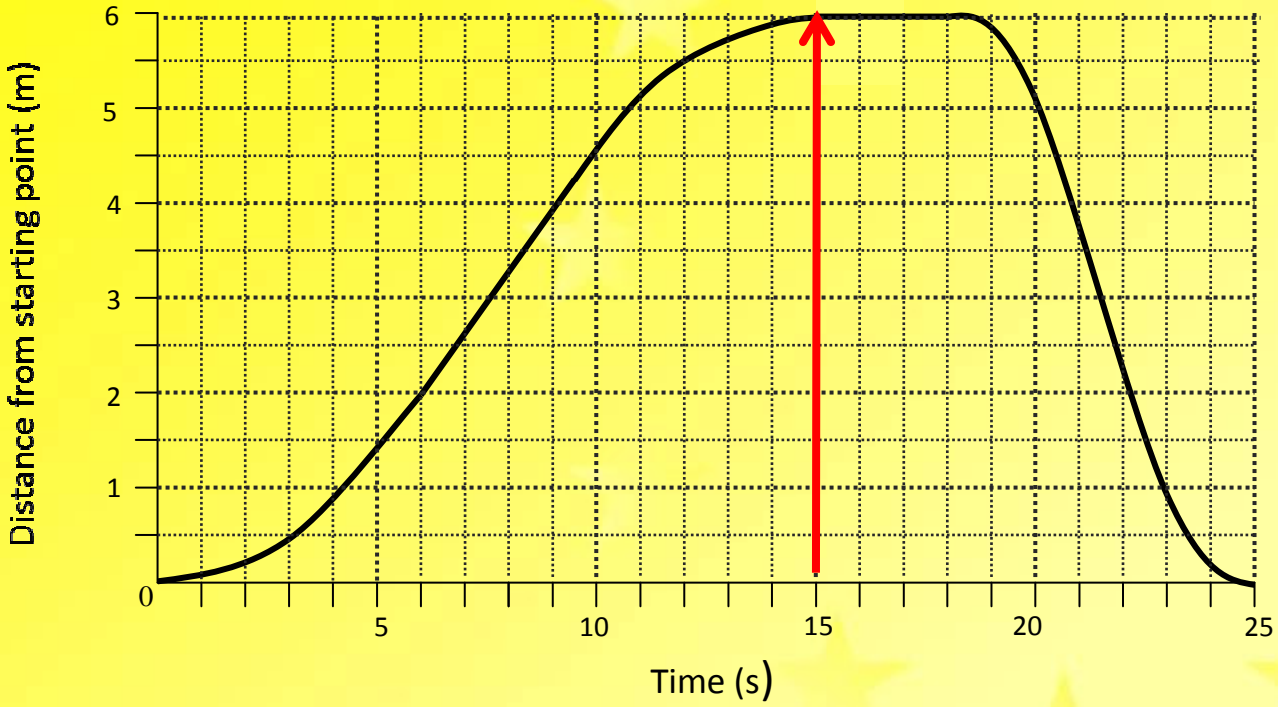
Distance = 6 m

Did you set out your calculations correctly?

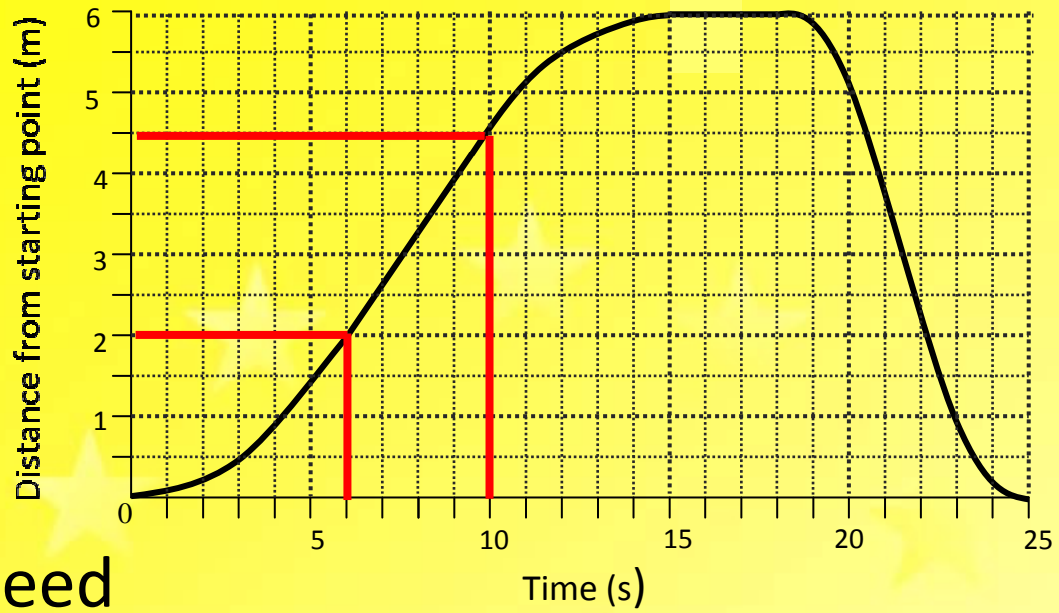
8. What is the speed of the car at 15s?

0 m/s

(It's not moving!)



9. What is the *maximum* speed of the car between 0s and 15s?



Car is at maximum speed between 6s and 10s

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

Time = 10 – 6 = 4s

Distance = 4.5 – 2.0
= 2.5 m

$$\text{Speed} = \frac{2.5}{4} = 0.63 \text{ m/s}$$

Why is this not the same as the average speed?

Average speed is lower as car spends some time speeding up and slowing down

Balanced and Unbalanced Forces

- Video