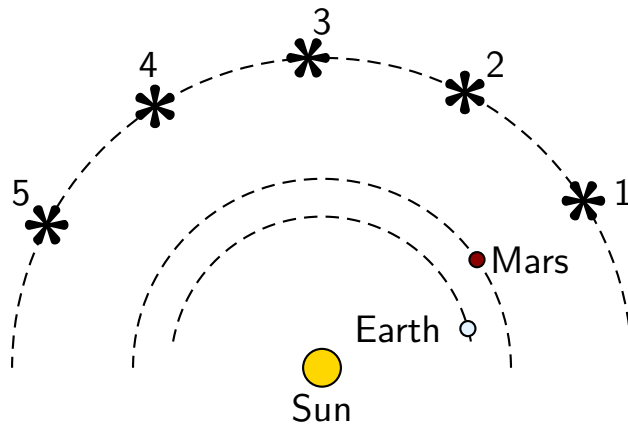


Question 1

Suppose that the position of Mars was viewed from the Sun. In Copernicus' heliocentric theory, the arrangement is illustrated below.



Which of the following is true?

1. Mars always exhibits retrograde motion, no matter where it is viewed from.
2. Mars will not exhibit retrograde motion when viewed from the Sun.
3. Mars will very occasionally and sporadically exhibit retrograde motion when viewed from the Sun; this will be less frequent than when viewed from Earth.
4. None of the above.

Question 2

In the heliocentric model of the solar system, the planets all orbit in approximate circles around the Sun. Some planets have orbits between the Sun and Earth. Other planets have orbits beyond Earth's orbit.

Which of the following about the phases of the planets as viewed from Earth is true in this model?

1. Any planet can display a “new” phase.
2. No planets can display a “new” phase.
3. Only planets beyond Earth's orbit can display a “new” phase.
4. Only planets with orbits between the Sun and Earth's orbit can display a “new” phase.

Question 3

Consider

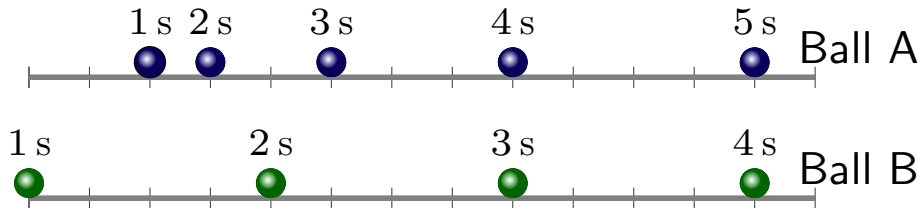
$$\frac{10^5 \times 10^{-2}}{10^{-4}}$$

Which of the following does this yield?

1. 10^{-7}
2. 10^{-1}
3. 10^3
4. 10^7
5. 10^{11}

Question 4

Two balls slide along horizontal surfaces. The positions of the balls are recorded at intervals spaced 1 s apart. These are illustrated in the diagram.

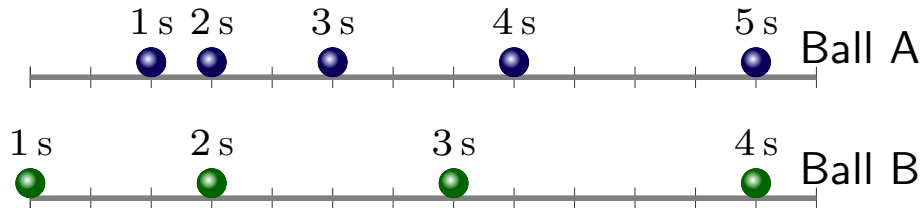


During the illustrated period, which of the following is true?

1. The acceleration of ball A is the same as the acceleration of ball B.
2. The acceleration of ball A is larger than the acceleration of ball B.
3. The acceleration of ball A is smaller than the acceleration of ball B.

Question 5

Two balls slide along horizontal surfaces. The positions of the balls are recorded at intervals spaced 1 s apart. These are illustrated in the diagram.

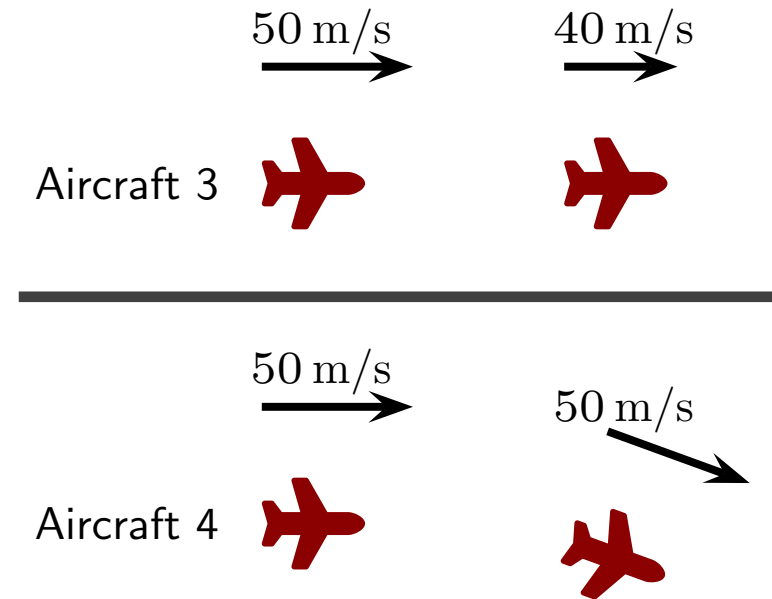
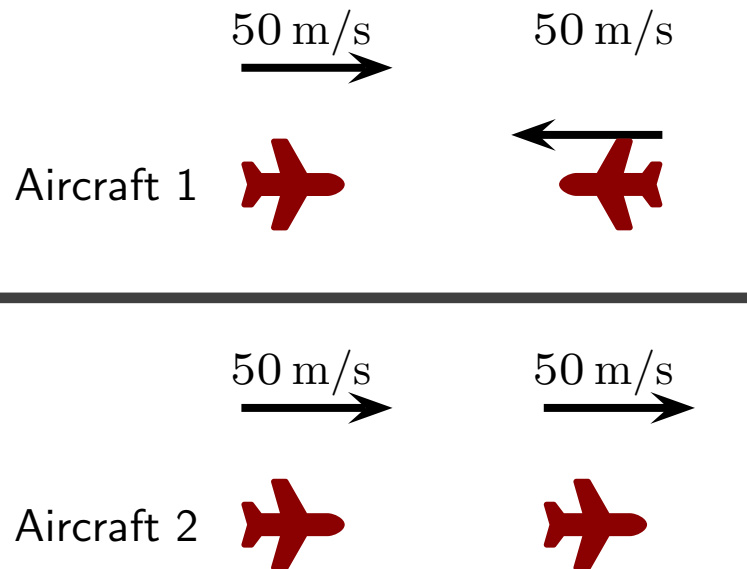


During the illustrated period, which of the following is true?

1. The acceleration of ball A is the same as the acceleration of ball B.
2. The acceleration of ball A is larger than the acceleration of ball B.
3. The acceleration of ball A is smaller than the acceleration of ball B.

Question 6

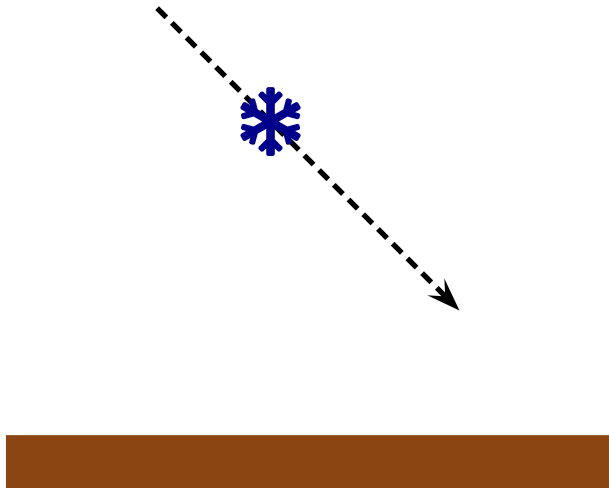
Various aircraft fly at the same altitude (height above ground). Their speeds and directions of motion at two moments are as illustrated below. For which of the following is the acceleration zero?



Show card "5" if "none of the above" is your response.

Question 7

A snowflake falls at constant speed toward the Earth in the illustrated direction.

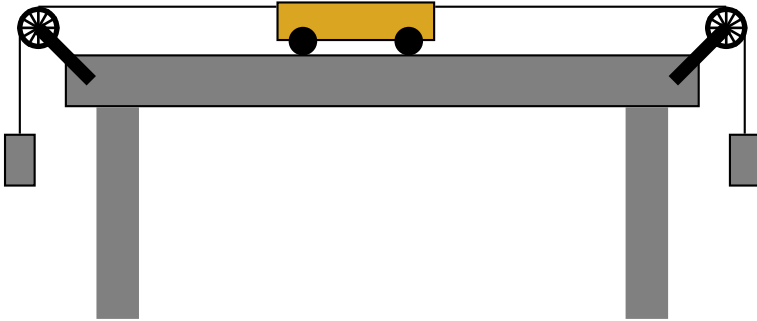


Which of the following best represents the net force on the snowflake?

1. Zero net force.
2. ↓
3. ↘
4. →
5. ↑

Question 8

A cart can slide back and forth along a frictionless track. Strings are attached to the cart and masses are suspended from them. For a while the cart is observed to move to the right with constant speed. Ignore air resistance.



Which of the following is true?

1. This is *only* possible if the mass on the right is larger than the mass on the left.
2. This is *only* possible if the mass on the right is smaller than the mass on the left.
3. This is *only* possible if the mass on the right is the same as the mass on the left.

Question 9

Phobos is a small moon of the planet Mars. The mass of Mars is more than one million times that of the mass of Phobos.

Which of the following is true regarding the gravitational force exerted by Mars (on Phobos) and that exerted by Phobos (on Mars)?

1. The gravitational force exerted by Mars is smaller.
2. The gravitational force exerted by Mars is larger.
3. The gravitational forces are the same.
4. The gravitational forces exerted by either Mars or Phobos depend on the gravitational force exerted by the Sun.