

Inertial Frames of Reference

the objects should
not accelerate!

QUIZ

Check your understanding:

In which of the following situations is there zero net external force on the object?

- (i) an airplane flying due north at a steady 120 m/s and at a constant altitude;
- (ii) a car driving straight up a hill with a 3° slope at a constant 90 km/h;
- (iii) a hawk circling at a constant 20 km/h at a constant height of 15 m above an open field;
- (iv) a box with slick, frictionless surfaces in the back of a truck as the truck accelerates forward on a level road at 5 m/s^2 .

if a truck starts
from rest, the box
will remain
stationary

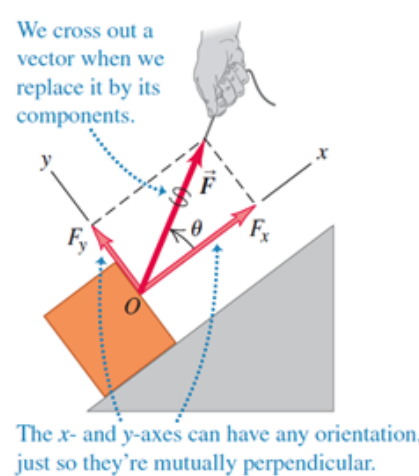
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Newton's Second Law

QUIZ

Check your understanding:

Figure shows a force \mathbf{F} acting on a crate. (a) With the x - and y -axes shown in the figure, is the x -component of the gravitational force that the earth exerts on the crate (the crate's weight) positive, negative, or zero? (b) What about the y -component?



(a) negative

(b) negative

QUIZ

Check your understanding:

Rank the following situations in order of the magnitude of the object's acceleration, from lowest to highest. Are there any cases that have the same magnitude of acceleration? (i) A 2.0 kg object acted on by a 2.0 N net force; (ii) a 2.0 kg object acted on by an 8.0 N net force; (iii) an 8.0 kg object acted on by a 2.0 N net force; (iv) an 8.0 kg object acted on by a 8.0 N net force.

$$(i\pi), (1) \& (iv), (11)$$

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Newton's Third Law

QUIZ

Check your understanding:

You are driving a car on a country road when a mosquito splatters on the wind-shield. Which has the greater magnitude: the force that the car exerted on the mosquito or the force that the mosquito exerted on the car? Or are the magnitudes the same? If they are different, how can you reconcile this fact with Newton's third law? If they are equal, why is the mosquito splattered while the car is undamaged?


$$F_1 = F_2 \quad \swarrow \text{mosquito}$$

$$\Rightarrow m_1 a_1 = M_2 a_2$$
$$M_2 \gg m_1 \Rightarrow \alpha_1 \gg \alpha_2$$

enormous acceleration



QUIZ

Check your understanding:

The buoyancy force is one half of an action-reaction pair. What force is the other half of this pair? (i) The weight of the swimmer; (ii) the forward thrust force; (iii) the backward drag force; (iv) the downward force that the swimmer exerts on the water; (v) the backward force that the swimmer exerts on the water by kicking.

action-reaction

↑ ↓

on swimmer on water

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