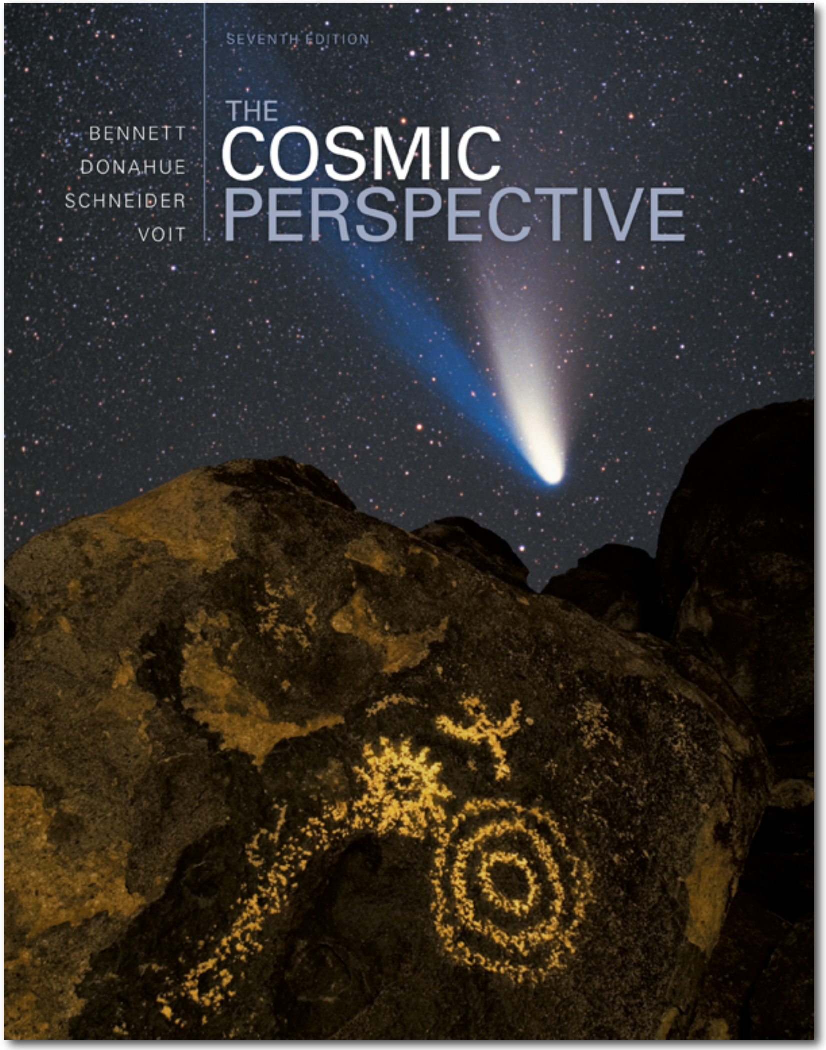
The Cosmic Perspective

Seventh Edition



Making Sense of the Universe: Understanding Motion, Energy, and Gravity

Which of the following give units for velocity?

a) feet/sec
b) meters/sec
c) inches/year
d) meters/sec/sec
e) A, B, or C

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Which of the following give units for acceleration?

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b) meters/sec
c) feet/sec/sec
d) meters/sec/sec
e) C or D

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d) meters/sec/sec
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What's the difference between velocity and speed?

a) They have different units.
b) Velocity includes speed *and* direction.
c) Nothing, they are different words for the same thing.

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Which of the following is true?

a) You can have acceleration not equal zero, but velocity equal to zero.
b) You can have acceleration equal to zero, but velocity not equal to zero.
c) You can accelerate without changing your speed.
d) all of the above
e) A and B

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e) A and B

What produces *acceleration* in a car?

a) the accelerator
b) the brake
c) the steering wheel
d) all of the above

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Momentum = _________

a) mass x velocity
b) mass x acceleration
c) rate of change of position
d) all of the above
e) A and C

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Changing an object's momentum requires

a) gravity.
b) applying a force.
c) applying a torque.
d) friction.
e) none of the above

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Angular momentum = ________

a) momentum x radius
b) mass x velocity x radius
c) mass x acceleration x radius
d) rate of change of position in orbit
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A long-handled wrench turns a bolt more easily than a short-handled one. Why?

a) A long handle applies more torque.
b) A long handle applies more force.
c) A long handle makes it easier to turn.
d) A and B
e) A and C

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Which of the following is true?

a) Astronauts in space can be weightless.
b) Astronauts in space can be massless.
c) Astronauts are far enough from earth they don't feel their weight.
d) Without air, there can be no weight.
e) all of the above

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Newton's second law, $F = ma$, (force = mass x acceleration), means that with no force,

a) objects remain at rest.
b) an object's speed doesn't change.
c) an object's velocity doesn't change.
d) B and C

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a) objects remain at rest.
b) an object's speed doesn't change.
c) an object's velocity doesn't change.
d) B and C

If there is no net force on an object

a) it doesn't move.
b) its velocity doesn't change.
c) its momentum doesn't change.
d) all of the above
e) B and C

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If a planet travels in a circular orbit <u>without</u> speeding up or slowing down, is it accelerating?

a) yes
b) no

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a) yes

b) no

If a planet travels in a circular orbit <u>without</u> speeding up or slowing down, does it have a force on it?

a) Yes
b) No

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a) Yes

b) No

Newton's second law, $F = ma$, applies to

a) a planet orbiting a star other than the Sun.
b) two binary stars orbiting each other.
c) the force needed to swing a rock on a string.
d) the force needed to push a car or bicycle.
e) all of the above

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Newton's law of gravity is $F = Gm_1m_2/d^2$

Can this be used to find the force between the Sun and a planet? If so, what is *d*?

a) no
b) yes, *d* is the diameter of the Sun
c) yes, *d* is the diameter of the planet
d) yes, *d* is the distance from the Sun to the planet

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Newton's law of gravity is $F = Gm_1m_2/d^2$

Can this be used to find the force between earth and you? If so, what is *d*?

a) No
b) Yes, *d* is the diameter of earth
c) Yes, *d* is the distance from you to the ground
d) Yes, *d* is the distance from you to the center of earth

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What is the common name for the force of gravity between earth and you?

a) terrestrial gravity
b) your gravitational force
c) your weight
d) your mass

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Which of the basic types of energy is illustrated when you stand on a ladder?

a) kinetic
b) potential
c) radiative
d) heat
e) none of the above

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Which of the basic types of energy is illustrated when you fall off a ladder?

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Which is an example of *changing gravitational potential energy* into *kinetic* (motion) energy?

a) eating food and releasing the energy
b) riding a bicycle
c) falling off a ladder
d) a gas cloud in space contracting due to gravity and heating up
e) C and D

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Temperature is a measure of

a) how much heat an object contains.
b) how fast atoms are moving.
c) how hot you feel when you touch something.
d) energy.

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The average kinetic energy something contains is called its

a) heat, heat content, or thermal energy.
b) temperature.
c) mean energy.
d) none of the above

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Thermal energy, or heat content, is a measure of

a) the temperature of a substance.
b) how many atoms or molecules are in a substance.
c) the product of temperature and number of atoms or molecules.
d) the total kinetic energy of the particles.
e) C and D

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d) the total kinetic energy of the particles.
e) **C and D**

A cake is baking at 400 degrees. If you briefly touch the cake you will not be burned. touch the metal pan for the same length of time and you <u>will</u> be burned. Why?

a) The metal is hotter than the cake.
b) The metal is denser than the cake–there are more atoms per unit volume.
c) The metal is a better conductor.
d) all of the above
e) B and C

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What causes the tides?

a) gravity from earth's core
b) gravity from the Moon pulling on the oceans
c) gravity from the Moon pulling harder on one side of earth than the other
d) gravity from the Moon or the Sun pulling harder on one side of earth than the other

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At any given time, how many high tides are there on earth?

a) one
b) two
c) none or one, depending on what time of day
d) none, one, or two–depending on the time of day

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When I drive my car at 30 miles per hour, it has more kinetic energy than it does at 10 miles per hour.

a) Yes, it has three times as much kinetic energy.
b) Yes, it has nine times as much kinetic energy.
c) No, it has the same kinetic energy.
d) No, it has three times less kinetic energy.
e) No, it has nine times less kinetic energy.

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Unique experiments can be carried out in the Space Station because of its lack of gravity.

a) Yes, and the Space Station was built in order to escape gravity.
b) This is not quite right – the Space Station still feels the effect of earth's gravity, but it is greatly diminished and the experiments are therefore referred to as being performed in "micro-gravity."
c) No, the uniqueness of the experiments is not due to the lack of gravity but to weightlessness.
d) No, similar experiments can be performed on earth's surface.
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How does the gravitational force between two objects change if the distance between them triples?

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b) the force increases by a factor of nine
c) the force remains the same
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If you could go shopping on the Moon to buy a pound of chocolate, you'd get a lot more chocolate than if you bought a pound on earth.

a) Yes, because of the lower gravity on the Moon, it would take more chocolate to weigh a pound than on earth.
b) Yes, chocolate would have a lower density on the Moon and therefore more is needed to reach a pound in weight.
c) No, a pound on the Moon is the same as a pound on earth.
d) No, chocolate weighs the same on the Moon as on earth.
e) No, mass (and energy) are always conserved.

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Newton's version of Kepler's third law allows us to calculate the mass of Saturn from orbital characteristics of its moon titan.

a) Yes, but we can measure Saturn's mass more precisely by measuring how long it takes to orbit the Sun.
b) Yes, knowing titan's period and semi-major axis allows us to calculate Saturn's mass.
c) No, we can only measure titan's mass this way, not Saturn's.
d) No, we have to measure all of Saturn's moons' orbits, not just titan's.
e) No, this can be done for other planets but not Saturn because of its rings.

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