Exam 1

- 24 multiple choice questions,
- 3 essay.
- Covers chaps. 1-9 and astronomy out of the supplement by Harrison (pgs. 21-27).
- Closed book, closed notes.

Exam 1

- Take exam in Grant Bldg. starting tomorrow through Monday, up to 4:00.
- No late fee associated with Monday, if taken before 4:00.
- Allow at least 1 hour for exam. Be aware of Testing Center hours!
- If you have special needs see me.

Reviews

There are two more review sessions today, conducted by the TAs.
Sarah Means 3:30 p.m. 280 MCKB,
Robin Shaw 5:00 p.m. C280 ESC
• Sample Exam in Harrison (pgs. 36-39). It is also available on the course home page.

Multiple choice. Here’s one:

P1: A light, styrofoam ball and a heavy, steel ball are suspended from a rope. Each is hit with the same amount of force by a stick. Explain the resulting motion.

(a) Neither ball will swing because each ball pushes back on the stick with the same force the stick exerts on the ball.
(b) Both balls will swing the same amount because the force is the same.
(c) Both balls will swing the same amount because the force from the cord balances gravity, so the weights don’t matter.
(d) The steel ball will swing more because it weighs more.
(e) The styrofoam ball will swing more because it has smaller mass.

Sources of knowledge

You accept the idea that the earth is spherical in shape because you were told this by a respected teacher. This is an example of knowledge gained by

- a) intuition.
- b) sensory data.
- c) reason.
- d) authority.
- e) none of these.

Size and complexity of material

Five levels of organization in the universe are listed below. If we start from the simplest, which is the next in terms of size and complexity?

- a) a nylon molecule
- b) a neutron
- c) a carbon atom
- d) a carbon nucleus
- e) a nylon jacket
**Interaction forces**

The force which holds the electron and proton together in a hydrogen atom is called
(a) weak force
(b) strong force
(c) electric force
(d) gravitational force
(e) galactic force

**Constant, unbalanced forces**

P2: When a body is acted upon by a constant unbalanced (net) force,
(a) it will move with constant speed in the direction of the force.
(b) its resulting acceleration will increase at a constant rate.
(c) its acceleration is constant and in the direction of the force.
(d) it will accelerate in a direction perpendicular to the force.
(e) it will experience an acceleration equal to the force times its mass.

**Death to mosquitoes!**

A truck moving at high speed collides with a mosquito. The truck hits the mosquito from the blind side, so that the mosquito couldn’t get ready.

During the collision which is true?
(a) The mosquito exerts a greater force on the truck than the truck on the mosquito.
(b) The truck exerts a greater force on the mosquito than the mosquito does on the truck.
(c) The acceleration of the mosquito is larger than the acceleration of the truck.
(d) The acceleration of the truck is larger than the acceleration of the mosquito.
(e) The mosquito should have kept his life insurance premiums paid up.

**Cannonball Express**

A long range cannon is fired at the same time that a marble is dropped from the roof of a nearby building. Neglecting air resistance, which of the following statements is true once the cannonball leaves the cannon?
(a) The speed of the cannonball is always the same as the speed of the marble.
(b) The velocity of the cannonball is always the same as the velocity of the marble.
(c) The acceleration of the cannonball is always the same as the acceleration of the marble.

**Weight**

You weigh a little less in Provo than on the west coast near Redwood National Park (same latitude). This is because
(a) you are closer to the center of the earth in Provo.
(b) you are farther from the center of the earth in Provo.
(c) the air’s buoyant force is greater in Provo than in California.

**Motion**

As you stand on an elevator which is moving with constant speed (it is halfway between floors) you are
(a) accelerating downward
(b) accelerating upward
(c) acted on by unbalanced forces
(d) moving with non-uniform motion
(e) not accelerating
**The Apollo experiment**

In a vacuum (on the moon), a falcon feather and a hammer fall with exactly the same acceleration. Which is true?

a) the gravitational pull on the two objects is the same.
b) the masses of the two objects are the same.
c) the gravitational pulls are different and the masses are different.

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**An uplifting experience**

A man in an elevator moves upward at constant speed. His motion may be understood in terms of:

- a) one force sideways
- b) one force downwards
- c) one force upwards
- d) two forces that balance
- e) two forces that don’t balance

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**More elevator fun**

- 1: Elevator sitting still.
- 2: Elevator just beginning to move upward.
- 3: Elevator moving up at constant speed.
- 4: Elevator just beginning to stop.
- 5: Elevator sitting still.

When would the man have the largest kinetic energy?

When would the net force on the man be upward?

When would the net force be Zero?

P3: When would the man’s contact force with the floor be largest (the largest apparent weight)?

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**Forces**

You are pulling your baby sister, sitting on a very light sled, across a frictionless ice skating rink. (You have ice spikes on your shoes.) If you added your sisters’ other three identical sisters to the sled and continued pulling with the same force, the resulting acceleration of the sled would be:

- a) the same
- b) \( \frac{1}{3} \) as great
- c) \( \frac{2}{3} \) times as great
- d) \( \frac{1}{4} \) as great
- e) \( 4 \) times as great.

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**Free fall**

Which one of the following statements about freely falling bodies in a vacuum is true?

a) A body thrown downward has more acceleration (after it is released) than one thrown upward (after it is released).
b) The more the body weighs the more acceleration it has.
c) A ball dropped from rest will hit the ground before a ball which originally moves horizontally.
d) The acceleration of an object that goes up and falls back down is not zero at the top.

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**Sweet tomato**

P4: A tomato sinks slowly at constant speed in a tub of slimy, wiggling brine shrimp. The motion of the tomato may be understood in terms of:

- a) one force sideways
- b) one force downwards
- c) one force upwards
- d) two forces that balance
- e) two forces that don’t balance
Buoyant Forces

Same size balls, different masses. Ball 1 is floating, partly submerged. Ball 2 is floating, completely submerged. Ball 3 is resting on the bottom.

Which ball is experiencing the largest buoyant force? Smallest?
Which ball has the largest density? Smallest?

Uncorked problem

P5: A cork floats with half its volume submerged
a) the buoyant force is equal to the volume of displaced water.
b) the volume of the cork is the same as that of the displaced water.
c) the weight of the cork is the same as the weight of the displaced water.
d) the buoyant force is equal to half the weight of the cork.

An electrifying problem

If the distance between two electric charges were doubled, the force would:
a) double
b) quadruple
c) decrease to one-half its strength
d) decrease to one-fourth
e) remain unchanged

Charge separation

A glass rod is rubbed with a silk cloth and acquires a positive charge.
(a) The rod now has more protons than electrons
(b) The rod now has less protons than electrons
(c) The rod now has equal numbers of electrons and protons
(d) There are now no protons remaining in the rod
(e) There are now no electrons remaining in the rod

Another electrifying problem

An electron has much less mass than a proton. When a proton and electron attract each other by the electric force, the force on the electron is:
a) slightly less than that on the proton
b) slightly more than that on the proton
c) much less than that on the proton
d) exactly the same as that on the proton

Newton’s Laws

- State Newton’s third law. Give two examples of actual physical behavior which illustrate it.
Motion of the moon

P6: The moon’s motion around the earth can be understood in terms of forces on the moon. Which is correct?

- a. One force directed towards the earth
- b. One force directed away from the earth
- c. One force in the direction of the moon’s motion
- d. Two forces that balance
- e. Two forces that do not balance

Moving in circles

If you see an object moving in a circle, you may be sure that it is experiencing,

- a) at least three or more forces
- b) at least two forces that do not balance each other
- c) at least two forces that balance each other
- d) at least one force
- e) no forces

Changing energy forms

When the engineer of a train sees a school bus on the tracks she locks the brakes of the train. The train screeches to a halt just before hitting the bus after sliding on a flat track for many blocks. Which of the energy transformations is largest?

- a) kinetic energy to internal energy
- b) internal energy to kinetic energy
- c) kinetic energy to gravitational potential energy
- d) internal energy to gravitational potential energy
- e) radiation

Mass and weight

At some future time you have the opportunity to travel to the moon. When you arrive you will find that

- a) Your mass is more than here on earth.
- b) Your weight is more than here on earth
- c) Your weight is less than here on earth.
- d) Your mass is less than here on earth.

Energy transfer

When hot air rises to the ceiling of a room on a winter day while the furnace is on, the process of transferring energy from floor to ceiling is

- a) radiation
- b) combustion
- c) conduction
- d) convection
- e) evaporation

Earth’s rotation

Which of the following is considered the most direct evidence for the rotation of the earth about its axis

- a) the procession of the constellations throughout the year
- b) the observed parallax of the stars
- c) the changing plane of motion of a Foucault pendulum
- d) the changing phases of the moon
- e) the motion of Jupiter’s moons about Jupiter.
**Conservation Laws**

A truck collides with a parked car. Because of the collision which of the following is true?

a) The total momentum of the truck and car increases.
b) No transfer of energy takes place.
c) The total energy increases.
d) The algebraic sum of all the electrical charges does not change.

**Potential energy**

The gravitational potential energy of a skier is decreased when she

a) rides up the ski lift
b) rides down the ski lift
c) moves faster on a flat trail.
d) costs up a small hill

**Rollerball**

P7: A ball rolls back and forth on a track. Friction causes it eventually to come to rest at the lowermost point on the track. At the end,

1) Kinetic energy is at its maximum.
2) Gravitational potential energy is at its maximum value.
3) Internal energy is at its maximum value.
4) All three (kinetic, G.P.E., internal) are at their minimum values.

Total energy is

1) not conserved.
2) conserved.

**Physicists with flares**

A flare is fired vertically (exactly) from a snowmobile moving in uniform motion across a frozen lake bed (neglect air friction). When the projectile returns to ground level

1) The projectile is significantly in front of the snowmobile.
2) The projectile lands on top of the snowmobile.
3) The projectile is significantly behind the snowmobile.

**More snowmobile fun**

If the snowmobile speeds up (accelerates), where does the projectile land?

P8: This demonstrates that

1) the uniform motion of a frame of reference is detectable.
2) the accelerated motion of a frame of reference is detectable.
3) neither uniform, nor accelerated motion is detectable.

**discussion question**

When is the rocket hardest to accelerate? (Neglect air friction.)
1. After jumping, a child lands on his feet on the ground. As the child is coming to a stop, what forces are acting on him? What directions are they in? Which must be the largest? Explain why.

2. A child is swinging on a playground swing. When she is at the “bottom” of a “swing” what forces are acting on her? In what directions are they acting? Which must be the largest of these forces? Explain why.

If a golf ball is hit with a large sledge hammer:

a) the force on the golf ball is less than the force on the sledge hammer
b) the force on the golf ball is greater than the force on the sledge hammer
c) the force on the golf ball equals the force on the sledge hammer

What is conserved?
Total energy?
Kinetic energy?
Gravitational potential energy?
Internal energy?

What happens to the energy as the pendulum swings? Consider transformations between the various forms of energy

Hey! Good luck!