Hey!

Let’s practice for Exam 1
Famous quotes from Einstein

"The only thing that interferes with my learning is my education."
 Exam 1

- Take it from now until Tues. (for a price)
- Allow 1 hour for the exam. Beware Testing Center hours!
- A proctored exam, for ESL students (English is a Second Language), will be given at 10:00AM. Sat. 31 in room C295 ESC. Please sign up in advance in the TA lab.
- TAs can go over the exam with you after the last late day.
Exam 1

25 multiple choice questions

Questions are typically in groups of 2-3 about a situation.
Preparing for exam questions

Same as the Focus Questions, homework questions and mini-labs!
Multiple choice

1. Read the situation
2. Read the question
3. Read any hints
4. Write the answer on scratch paper
5. Find the answer among the choices

Don’t try to justify answers. Most of the choices are there because they represent common misconceptions.
**Key Words for Newton**

- 1\(^{st}\) Law – Balanced forces = uniform motion
  - Look for words like “straight line at constant speed”
- 2\(^{nd}\) Law – Acceleration / changing motion
  - Look for words like “just beginning to move,” “slowing to a stop,” or “moving in a circle”
- In both the 1\(^{st}\) and 2\(^{nd}\) law situations you will be asked to compare the size of forces on a single object.
- 3\(^{rd}\) Law – Equal forces on pusher and pushee
  - Look for 2 different objects interacting with each other
  - Questions that ask you to compare the size of forces on 2 different objects.
**Constant, unbalanced forces**

When a body is acted upon by a constant unbalanced 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) it will accelerate 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.
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

\[\text{c) the force on the golf ball equals the force on the sledge hammer}\]
Lunar forces

The earth is 81 times more massive than the moon. Hence:

a) the gravitational pull of the earth on the moon is 81 times the pull of the moon on the earth.

b) the gravitational pull of the moon on the earth is 81 times the pull of the earth on the moon.

c) the two pull on each other with gravitational forces of the same strength.
A book is lying on the table. The reaction (the second force required by the Third Law of Motion) to its weight is

a) The force of the book pushing down on the table.

b) The force of the table pushing up on the book.

c) The gravitational pull of the book on the earth.

d) The gravitational pull of the earth on the table.

e) The gravitational pull of the earth on the book.
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) no forces

b) one force downwards

c) one force upwards

d) two forces that balance

e) two forces that don’t balance
Death to mosquitoes!

A hand moving at high speed collides with a mosquito. Which is true?

a) The mosquito exerts a greater force on the hand than the hand on the mosquito.

b) The hand exerts a greater force on the mosquito than the mosquito does on the hand.

c) The mosquito should have kept his life insurance premiums paid up.
Gravity

Force depends on mass

Acceleration is the same (mass cancels)

- Look for situations where gravity is the only force on objects.
The Apollo experiment

In a vacuum (on the moon), a falcon feather and a hammer are dropped. Which is true?

a) the gravitational force on the two is the same.
b) the masses of the two are the same.
c) the accelerations of the two are the same.
d) The energies of the two are the same.
It is experimentally observed that the gravitational accelerations of all objects are the same even if their weights are different. Which law or laws of the Newtonian synthesis predict this result?

a) The Second Law of Motion
b) The Third Law of Motion
c) The Law of Gravitation
d) The Second Law of Motion and the Law of Gravitation
If the distance between two electric charges were doubled, the force would:

- a) increase
- b) decrease
- c) remain unchanged
EINSTEIN CONDUCTS A THOUGHT-EXPERIMENT

IF A PERSON WERE TO WAKE UP VERY EARLY - SAY 5 A.M. BEFORE SUNRISE - AND EAT BREAKFAST IMMEDIATELY, HE COULD EAT LUNCH AT ABOUT 10:30 A.M. BY 3:30 OR 4 P.M. HE COULD PROBABLY EAT ANOTHER LUNCH. WHAT A BREAKTHROUGH - TWO LUNCHES IN ONE DAY!
Jogging too fast (close to the speed of light) makes you
- short (length contraction),
- fat (mass increase),
- and slow (time dilation).

Things that happen at the same time in one reference frame will NOT happen at the same time in another frame.

2 postulates with lots of consequences.
- 1) speed of light is the same &
- 2) laws of nature are the same for observers in uniform motion.
Key words for buoyancy

Same size or volume … same buoyant force and different weights
Same mass …. same weight and different buoyant force
Floating = at rest …. forces balance
Sink or swim

A beach ball and bowling ball of the same size are held under water. When they are released the beach ball pops to the surface while the bowling ball sinks. Why?

a) The beach ball has a greater buoyant force than the bowling ball.

b) The beach ball’s buoyant force is up, while the bowling balls buoyant force is down.

c) The bowling ball weighs more than the surrounding fluid, and the beach ball weighs less.

d) The bowling ball weighs more than the beach ball.
Uncorked problem

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.

*What happens to the buoyant force if you push the cork under water?*
“It’s hard to tell you this, Melnik, but you’re being sent down to the Institute for Pretty Hard Thinking.”
A bungee jumper dives off of a high bridge. The first time he ‘hits bottom’

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

He bobs up and down eventually coming to a stop.

Total energy is

1) not conserved.
2) conserved.
An uplifting experience

A man in on a ski lift moves 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

Suppose he is skiing downhill at constant speed:
What can you tell me about the forces?
What can you tell me about his energy?
Motion of the international space station

The ISS’s motion around the earth can be understood in terms of:

a) one force sideways (in the direction it moves)

b) one force downwards (towards the Earth)

c) one force upwards (away from the Earth)

d) two forces that balance

e) two forces that don’t balance
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
"But don't you see, Gershon—if the particle is too small and too short-lived to detect, we can't just take it on faith that you've discovered it."
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 could be 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.
The buoyant force on an object immersed in a fluid depends upon

a) the weight per unit volume of the object.
b) the weight of the object.
c) the volume of the object.

Why does a ball bearing made of steel sink in water, but a battleship made of steel float?
If the diver releases the weights from his hand,

a) his weight increases.

b) his buoyant force increases.

c) his buoyant force decreases.

d) he will sink.
Physicists with flares

A flare is fired vertically (exactly) from a snowmobile moving in uniform motion across a frozen lake bed. 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.
If the snowmobile speeds up (accelerates), which is true? 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 are detectable.
A fire place is not a very efficient way of heating a house because a lot of the heat escapes up the chimney, the heat is being lost by:

a. Work
b. Heat Flow/Conduction
c. Radiation
d. Convection
e. Chemical reaction
For which of the following predictions of Special Relativity is there experimental evidence?

a) Time dilation  
b) Length contraction  
c) ‘c’ as nature’s speed limit  
d) Mass increase  
e) Mass-energy equivalence  
f) All of the above
Mr. Rogers Predicts

Which is not a prediction of the Special Theory of Relativity but rather an assumption (i.e. postulate)?

a) The mass of an object increases with its speed.
b) Clocks moving relative to one another do not measure a unique “absolute time”.
c) The speed of light in empty space is the same for all observers in uniform motion.
d) Mass-energy is conserved.
e) Measured lengths are shorter when measured by moving observers.
Weightless?

Explain why an astronaut in orbit is or is not weightless.
Hey!

Good luck!