Welcome!

Find a seat where you can read the screen and discuss with a partner.

Take out your class notes, equation sheet, calculator, and scratch paper.

Take a few deep breaths, enjoy the music, smile – you got this!

Physics 1200: Exam 1 Review Part 1

Atomic Properties, Quarks, Phases of Matter, Volume, Density Pressure, Bernoulli Principle

Big Ideas

- Physics describes the universe at a fundamental level using the basic concepts of *what matter is* and *how it interacts*.
  - Matter:

    Stuff – Molecule – Atom – Nucleus – Quark
  - Interactions:

    Gravity – Electromagnetic – Nuclear

Big Ideas

- Science is an accumulation of observations made by many people; our description of reality is always being refined.
  - Throwing atom models in the trash
  - No all-encompassing textbook – still discovering!

MATCHING: Scientist - Contribution

1) Sir Isaac Newton
2) Aristotle
3) Hildegard von Bingen
4) Benjamin Franklin
5) J.J. Thompson
6) Ernest Rutherford
7) Dmitri Mendeleev
8) Edwin Hubble
9) Antoine & Marie Lavoisier
10) Marie Fairfax Somerville

A. Plum pudding atom model – negative electron
B. Published experiments finding 23 basic elements
C. Spread knowledge by translating Aristotle's work
D. Explored concept of positive-negative charge
E. Gold-foil experiment – small positive nucleus
F. Deduced that Earth is made of 4 elements
G. Self-taught scholar, translated Newton's work
H. Organized known elements into table format
I. Did ground-breaking research in astronomy
J. Described 3 basic laws of motion mathematically

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Big Ideas

- The atom is not the smallest particle of matter
  - but smallest piece that retains properties of an element
  - ex. “an atom of gold is still gold”
- Each atom contains smaller particles:
  - a small, positively-charged nucleus (protons, neutrons)
  - surrounded by even smaller, negatively-charged electrons
  - most of the volume is empty space

SOLVE IT! (Atomic Properties)

1. An atom has 26 protons.
   Which element is it? What is its atomic mass?

2. Many advertising signs contain Ne (neon) gas.
   How many protons does the element Ne have?
   How many nucleons (particles in the nucleus) total?
   About how many neutrons are in a typical Ne atom?

1. In nature there are several isotopes of O (oxygen).
   What is an isotope? How many neutrons are in the most common isotope of oxygen?

Big Ideas

- The periodic table is arranged by:
  - increasing atomic weight (rows)
  - similar chemical properties (columns)
  - increasing ratio of neutrons to protons

- Something has *charge* if it has more or less electrons than its usual neutral state.

- Protons and neutrons are composed of smaller particles called quarks.
  - Proton (+1 charge): quarks (up, up, down)
  - Neutron (0 charge): quarks (up, down, down)
  - Electron (-1 charge): NOT made of quarks

SOLVE IT! (Charge and Quarks)

1. You have two particles, A and B, and you want to determine their charge. When you bring A near B, they repel. What do you know?

2. Draw a diagram that represents the structure of an atom of Li (lithium) down to the level of quarks.

3. You have examined an atomic particle with the following properties: charge(+1), baryon#(0), strange(+1), charm(+1), top(0), and bottom(0).

   Which quarks does this particle consist of?
   Does that mean this particle is a meson or a baryon?

Big Ideas

- Despite our knowledge about the atomic level, generally we interact with matter *in bulk*.

- Matter in bulk can be described in several ways
  - Mass (how much?)
  - Volume (how big?)
  - Density (how heavy?)
  - Temperature (how hot?)
  - Phase/State (what kind?)

Big Ideas

- Mass: How much?
  - Units: kilograms (kg)

- Volume: How big?
  - Volume (of box) = Length x Width x Height
  - Units: cubic meters (m^3)

If you know mass and volume, you can calculate…

- Density: How heavy?
  - $Density = \frac{Mass}{Volume}$ Units: $\frac{kg}{m^3}$

SOLVE IT! (Volume and Density)

1. Before you travel on an international flight, you want to make sure your suitcase is within the size limit. This particular airline will not allow any baggage with a volume exceeding 45000 cm^3. You measure your bag to have a height of 55 cm, length of 35 cm, and width of 23 cm. Will your suitcase pass security?

2. As you were flying over Switzerland, unfortunately the cargo doors opened and your suitcase fell into Lake Geneva. You remember that the suitcase weighed in at ~28 kilograms! Will your suitcase float? If it floats, how much of the bag will be underwater? If it sinks, how much money will you sue the airline for?

Big Ideas

- Temperature: How hot?
  - Fahrenheit (32—212), Celsius (0—100), Kelvin
- Phase/State: What kind?
  - Solid ⟹ Liquid ⟹ Gas ⟹ Plasma
  - Depends on how tightly connected the particles are
- Adding energy to matter will either increase its temperature or change its phase/state.

Big Ideas

- Pressure is how much force is exerted over a certain area.
  - $\text{Pressure} = \frac{\text{Force}}{\text{Area}}$
  - Bed of one nail vs. Bed of many nails
  - High-heeled shoe vs. Tennis shoe

- Bernoulli Principle: Faster-moving fluid creates a zone of low pressure.
  - Roof flying off during a wind storm
  - Shower curtain attack

SOLVE IT! (Matter and Pressure)

1. As you continue to fly over the Alps, you notice that you can observe water in a glacier, a lake, and clouds. Draw and label simple pictures of the *four* states of matter. Describe the type of bonds that determine each phase.

2. A certain flight attendant weighs 135 pounds (600 N). She has two pairs of shoes with different areas of surface contact: flats 150 cm^2 (0.015 m^2) and high-heels 30 cm^2 (0.003 m^2). How much pressure does she exert on the plane floor in each pair of shoes?

3. As you stare out the window, you marvel that the huge metal plane can fly through the air because of the shape of the airplane's wings (flat on bottom, curved on top). What does this have to do with pressure?

Welcome!

Find a seat where you can read the screen and discuss with a partner.

Take out your class notes, equation sheet, calculator, and scratch paper.

Relax, meet someone new, smile – you'll be fine!

Physics 1200: Exam 1 Review Part 2

Velocity, Acceleration, Graphs, Force

MATCHING: Scientist - Contribution

1) Sir Isaac Newton
2) Aristotle
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4) Benjamin Franklin
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Big Ideas

- Position: where you are
- Distance: how far you've travelled
  - *Net distance*: straight line on map, not odometer
- Velocity: a change in position over time
  - $\text{Ave. Velocity} = \frac{\text{distance}}{\text{time}} = \frac{\text{initial v} + \text{final v}}{2}$
  - *Instantaneous velocity* can only be calculated, not measured
- Acceleration: a change in velocity
  - $\text{Ave. Accel.} = \frac{\text{change v}}{\text{time}} = \frac{\text{final v} - \text{initial v}}{\text{time}}$
  - Acceleration devices in a car: gas pedal, brake pedal, steering wheel

TALK ABOUT IT: Velocity - Acceleration

- If you are given a distance and a time, what other value(s) can you calculate?
- How would you manipulate the average acceleration equation to get an equation for final velocity?
- If a satellite is moving at a constant speed in orbit around the Earth, is it accelerating?

SOLVE IT: Velocity - Acceleration

1. Your friends plan a road trip from Logan to Las Vegas. MapQuest tells you that the 500-mile trip will take you about 8 hours. What average velocity (in mph) does MapQuest assume you will have? Choose a more reasonable average velocity and calculate how long the trip will actually take.

2. After stopping at the red light as you enter Brigham City, you speed up to 30 mph (14 m/s) in 3 seconds. Then while merging onto the freeway, you go from 30 mph (14 m/s) to 75 mph (34 m/s) in 5 sec. In which situation did you have more average acceleration?

Big Ideas

- Interpreting graphs
  - position/time vs. velocity/time
- Use table and equations on equation sheet
  - plus any math-slope knowledge
- Go step-by-step
  - by column is easiest
- Be able to answer questions
  - zeros

GRAPHS: Position/Time

- Make a position/time graph from the following:

  initial position = 0

  initial velocity = +6.0 m/s

  acceleration = -2.0 m/s/s

1. Use graphing table to show work
2. Solve for final velocity and fill out first two velocity columns
3. Use that info to calculate average velocity
4. Use average velocity to calculate distance
5. Use distance to fill out the last two position columns

TALK ABOUT IT: Analyzing Graphs

- At what time(s) was the object at the zero position?
- At what time(s) did the object have zero velocity?
- At what time(s) did the object have zero acceleration?
- At what time(s) did the object have the greatest acceleration?
- At what time(s) was the object farthest from the initial position?

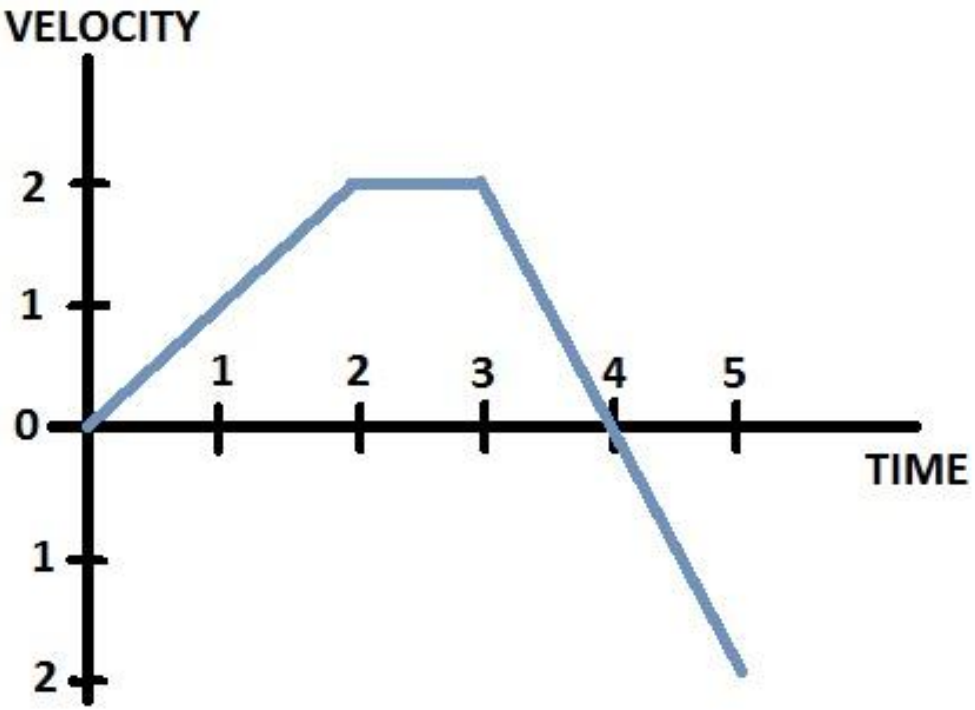
SOLVE IT: Velocity - Acceleration

3. While in Las Vegas, your friends go swimming at a water park that has a 90-foot high dive. Downward acceleration due to gravity is about 10 m/s/s. If you fall for 2 seconds after you step off, how fast are you going when you hit the water?

4. As you are driving back to Logan late at night through Sardine Canyon, you glance at your speedometer and it reads 65 mph (29 m/s). When you look back up, a deer jumps out into your lane exactly 150 ft (46 m) ahead of you. Ahhh! You slam on the brakes that decelerate the car by -10 m/s/s. How long will it take for you to stop? By calculating distance, will you save the deer's life or not?

GRAPHS: Velocity/Time

- From the velocity graph below, calculate the distance the object travels each 1 sec. interval. (use graphing table)



1. Use initial and final velocities from graph to find average velocity
2. Use average velocity to calculate distance

GRAPHS: Velocity/Time

- Given an initial position of -5m, calculate the object's position at each second.
  3. Use distance to fill out the last two position columns

- Draw the associated position/time graph.

TALK ABOUT IT: Analyzing Graphs

- At what time(s) was the object at the zero position?
- At what time(s) did the object have zero velocity?
- At what time(s) did the object have zero acceleration?
- At what time(s) did the object have the greatest acceleration (in magnitude)?
- At what time(s) was the object farthest from the initial position?

Big Ideas

- Objects with mass attract via the gravitational interaction.
- Objects with charge attract/repel via the electric interaction.

I. All objects will maintain a constant velocity (even zero) unless it experiences a net force.

II. $\text{Accel.} = \frac{\text{Forces}}{\text{Mass}}$ $\quad \text{Force} = \text{Mass} * \text{Accel.} \quad \text{Mass} = \frac{\text{Force}}{\text{Accel.}}$

III. When an object exerts a force on another object, the other object exerts an equal but opposite force back.

QUESTIONS: Forces

Multiple Choice:

- A USU bus runs into a poor pedestrian crossing the road. Which of these statements is true?
  a) The only force is from the bus to the person
  b) There is a force from both, but the force from the bus is larger
  c) There is a force from both, and these forces are equal
  d) There are no forces involved

Short Answer:

- Does the bus or the person get accelerated more? Why?

Don’t forget to review Ch.4 homework!