Study Guide for Physics 1100 Final Exam

Dr. Fazzini's Physics 1100 Final Exam will take place on
Wednesday, December 17th , 2025 from 9:00AM-10:50AM in Room BIC-3535.

Click on the "Detailed Class Information" link on our class web page to locate the **Course Objectives** in the syllabus.

Summary by Topics:

Measurement / Variables / Hypotheses

Be able to keep track of units and be able to use conversions. For example: Given: Speed = 60 mile per hour, what is this speed in meters per second? (You would be given that 1.6 km = 1 mile, and 1000 m = 1 km).

Be able to identify the independent variable, the dependent variable, and any controlled variables in an experiment that is described and be able to evaluate the validity of such an experiment.

Newton's 1st Law of Motion

Be able to cite Newton's 1st law. What is the behavior of an object when there are no net forces (pushes or pulls) on that object?

What is "inertia"?

What does it mean to be in "equilibrium?" Distinguish between static equilibrium and dynamic equilibrium.

Linear Motion

Be able to distinguish position, displacement, path, average speed, average velocity and average acceleration. Be able to calculate these.

Distinguish between instantaneous speed and instantaneous velocity.

Be able to interpret position vs. time and velocity vs. time graphs. Be able to deduce a velocity graph from a position graph.

Be able to apply $v = at$ and $d = (1/2)at^2$ in appropriate situations.

(Take the acceleration due to gravity as 10 m/s^2 downward near the Earth's surface.)

Newton's 2nd Law of Motion

Be able to sketch a force vector diagram on an object showing all the forces that act on that object.

Be able to sketch the resultant vector from the addition of 2 or more vectors.

Be able to resolve a given vector into components parallel and perpendicular to some chosen set of coordinate axes.

Be able to distinguish between mass and weight.

Newton's 3rd Law of Motion

Be able to identify action/reaction pairs of forces. Remember action/reaction pairs act on different objects. For example: Earth pulls down on apple = Action. Then the reaction is: Apple pulls up on Earth. (Does it really make a difference which one of the pair is called the "action?")

Distinguish between internal and external forces acting on a given system.

Momentum

Be able to distinguish momentum and impulse. (Impulse is a CHANGE IN momentum).

Remember that "change in (whatever)" = $\text{whatever}_{(\text{after})} - \text{whatever}_{(\text{before})}$.
The symbol for "change in" is "Δ". The symbol for momentum is "p".
Impulse = $\Delta p = \Delta(mv)$. Also, $\Delta p = F(\Delta t)$.

Be able to deduce the outcome of a collision. That is, be able to solve problems such as PROBLEMS 2, 4, 6, 8 at the end of Chapter 6 in our textbook.

Use conservation of momentum $p_{(before)} = p_{(after)}$ for a system with no external forces acting it.

Energy

Be able to compute the work done by a force ($W = F_{(\text{parallel})}$ x displacement) and the rate at which work is done (Power = W/t).

Distinguish different forms of mechanical energy:
Kinetic Energy = $(1/2)mv^2$ Gravitational Potential Energy = mgh

Be able to solve problems such as: How fast does object go at the bottom ramp given some conditions by using conservation of energy.

Rotational Motion

Be able to distinguish rotational and linear variables (like Linear Velocity and Angular Velocity).

What is rotational inertia? What keeps an object moving in a circle? What is center-of-mass? What determines the stability of an object?

Be able to solve simple balancing problems like you did (or will do) in the lab.

What is angular momentum? (Angular momentum = $I\omega$) Be able to describe the behavior of rotating objects using conservation of angular momentum.

Gravity

Be able to calculate the gravitational force between two objects whose centers are separated by some distance. Know what it means when something obeys an "inverse-square law".

What interpretation of gravity did Albert Einstein promote?

Projectile / Satellite Motion

Be able to determine the position of an object thrown at some angle near the surface of the Earth at some later time. What are the components of the object's velocity?

How do the vertical and horizontal components of velocity behave when an object is thrown at an arbitrary angle near the surface of the Earth?

What are Kepler's Laws of Planetary Motion? What do they mean?

Atomic Nature of Matter

Be able distinguish *elements*, *compounds*, *mixtures*, *atoms*, *molecules*.
Know structure of atoms: Where are the *protons*, *neutrons*, *electrons* in an atom? What are protons and neutrons made of?

Be able to use a periodic table (it will be provided), to use information regarding *atomic number* & *atomic mass*. (Look at questions 22 & 23 in Chapter 11).

What is *antimatter*? What is *dark matter*?

Solids

Be able to distinguish *mass*, *volume*, *weight*, *density*.

Be able to calculate *density* if given the mass and volume of a substance.

Be familiar with *elasticity*: that the amount of stretch force (or compression force) is proportional to the change in length (*Hooke's law*). (See p. 231)

If given diagrams (like those on page 232), be able to tell where the *tension* occurs and where the *compression* occurs.

Be able to describe *scaling* effects (for example, "surface area to volume ratio").

Liquids

Be able to calculate *pressure* in a liquid at a given depth.

Be able to calculate *buoyant force* on a submerged or floating object knowing that the magnitude of the buoyant force is equal to the weight of the fluid displaced. (*Archimedes Principle*)

Be able to relate the density of a floating object to the fluid it is in by noting the fraction of the submerged portion.

Be able to use *Pascal's Principle* to explain a "hydraulic lever" (see page 255).

What is *surface tension*? What is *capillarity*? Be able to distinguish between *cohesive forces* and *adhesive forces* between atoms and molecules.

Gasses & Plasmas

Be able to use *Boyle's Law* to relate pressure and volume. For example:
If the volume of a container of gas is cut in half, what happens to the pressure?

Note that air is fluid and that an object in air also experiences a buoyant force equal to the weight of the air displaced by the object (see p. 271-2).

Bernoulli's Principle: where the speed of a fluid increases, the pressure decreases and vice versa.

What is *plasma*? What are some examples?

Temperature, Heat & Expansion

Be able to distinguish *temperature*, *heat*, and internal *energy*.
Be able to convert between *Celsius scale* and the *Kelvin scale*.

Understand the fundamental meaning of *specific heat capacity* and be able to use $Q = mc\Delta T$. (See Problems: 37-39 at the end of Chapter 15 on p. 298)

Expansion of materials: $\Delta L/L = \alpha \Delta T$

Heat Transfer

Be able to distinguish between *conduction*, *convection* and *radiation*.

Which is hotter: a red-hot object or a blue-hot object? Why?

What is *Newton's law of cooling*? (What does ΔT represent in the equation?)

Change of Phase

Know whether *evaporation* or *condensation* is a cooling or warming process and why.

Be able to use $Q = mL$ to calculate *latent heat of transformation*. For example: How much heat is required to change 10 g of ice at 0 °C to water at 0 °C? For example, try Problem 37 at the end of Chapter 17 (p. 333).

Thermodynamics

Be able to cite the first 2 laws of thermodynamics. What is an *adiabatic* process?

Be able to calculate the *efficiency* of a heat engine operating between 2 temperatures or the *coefficient of performance* of a refrigerator. (Be sure to use Kelvin temperature!)

What is *entropy*? Be able to calculate the probability for a simple event (for example, like we did in class with the rolling of dice).

Vibrations, Waves & Sound

Be able to identify the *amplitude*, *wavelength*, *frequency*, *period* and *wave speed* for a wave if given a picture and/or numbers.

Be able to distinguish *transverse* and *longitudinal* waves.

What is interference? Be able to distinguish between *constructiv*e and *destructive* interference.

What is the *Doppler effect*? What are *beats*? What is *resonance*?

Be able to describe how the angle of a bow wave or Mach cone varies for speeds greater than the speed of the wave through that medium.

Be able to identify resonance modes of a vibrating air column or string from numbers or a picture. Where are the *nodes*? Where are the *antinodes*?

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Electrostatics

Be able to find the magnitude and direction of electrical forces between charges using Coulomb's Law. (How do 2 "like" changes behave if near each other? How do "opposites" behave?)

What are the conventional directions of electric field lines due to charges?

Distinguish between *conductors*, *semiconductors*, *superconductors*, *insulators*.

Know the relationship between *electrical potential energy*, *electrical potential* and *charge*.

Electric Current

Be able to apply Ohm's Law to relate *voltage* (electrical potential), *current* and *resistance*.

Be able to identify and use electrical units properly
(for example: Volts, Amperes, Coulombs, Ohms).

Be able to distinguish between series and parallel circuits. Be able to predict bulb brightness in various circuits.

Be able to determine equivalent resistance for a network of resistors in series or parallel.

Be able to compute electric *power* delivered by a battery or dissipated by a resistor.

Magnetism & Magnetic Induction

Be able to recall experiences in the lab and lecture: Opposite poles attract, like poles repel and induced currents are caused by changing magnetic fields.

Be able to distinguish different devices: *electromagnets*, *motors*, *generators*, *transformers*.

Be able to calculate input and output voltage, current and power for a transformer.

Light

Be able to describe the relationship between the color of a glowing object and its temperature. (See Heat Transfer above.)

Compare color mixing of light and color mixing of paints in terms of *absorption*, *reflection*, and *transmission*. (Examples: Why is the sky blue and why are sunsets red?)

Be able to describe the behavior of light interacting with by plane, concave, and convex mirrors and lenses.

Explain the phenomena of *reflection* and *refraction*. What is *total internal reflection*?

Be able to identify components of the electromagnetic spectrum
(for example: radio waves, infra-red, X-rays, etc.)

Be able to explain in terms of vector components, the intensity of light passing through a system of polarizing filters.

Be able to distinguish *incandescence*, *fluorescence*, and *phosphorescence* in light emission.

Be able to calculate interpret energy level diagrams and photon energies using $E = hf$. (For example, see Chapter 30 Exercises 29 (p. 579) and 76 on (p. 580).

What is the *photoelectric effect*? What is the evidence for wave-like and particle-like properties of light and matter?

Atomic and Nuclear Physics

Be able to explain the Bohr model of the atom and origin of atomic spectra.

What is *radioactivity*? Why atoms are radioactive? Be able to calculate *half-life*.

Distinguish the different types of radiation: *alpha*, *beta*, *gamma.*

What is *transmutation*? Be able to identify the products in a decay series.

Distinguish nuclear fission and fusion. What is a *critical mass*?

What is meant by *mass-energy equivalence*?

Be able to describe nuclear fission and fusion processes and their importance in society.