IDX G9 Physics S
Study Guide Issue S1 Finals
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Contents:

4-2:

Scales

- Spring force is a restoring force that is the push or pull a spring exerts on an object
    - A spring scale measures weight, not mass
        - In equilibrium: Fsp = Fg
        - With a constant acceleration: Upward: Fsp > Fg

          Downward: Fsp < Fg
            - Special case: free fall -> Fsp = 0N
    - Weightlessness does not mean that an object's weight is actually zero, but means that there are no contact forces pushing up on the object and its apparent weight is 0
- The force exerted by the scale is called the apparent weight

Drag Force and Terminal Velocity

- Ideal case: no air resistance
- In actuality: drag force -> the force exerted by a fluid on the object moving through the fluid
- Drag force depends on:
    - 1. Motion of the object
    - 2. Properties of the object
    - 3. Properties of the fluid
- Terminal velocity: The drag force on an object increases as its velocity increase. When the drag force increases to the point that it equals the force of gravity, the object will no longer be accelerated
- Parachuting: A parachutist will have two different terminal velocities. Before opening the parachute & after it is opened

4-3:

- Interaction pair
    - Forces always come in pairs – F A on B and F B on A
    - Opposite directions and equal magnitude
    - Also called: action-reaction pair of forces
- Newton's Third Law
    - The force of A on B is equal in magnitude and opposite in direction of the force of B on A
    - F A on B = -F B on A

!-1:

- Physics is the study of matter and energy and their relationships
    - Science – natural science, social science
- Unit
    - SI system: Also called international system of units is a base 10 system of measurement that is the standard in science
        - Mass: kg
        - Length: m
        - Time: s

        - Temperature: kelvin
        - Substance: mole
        - Electric current: ampere
        - Luminous intensity: candela
    - Derived units: Created by combining the SI units
        - N = kg* m/s_2
        - J = kg*m_2/s_2
- Dimensional Analysis
    - The method of treating the units as algebraic quantities
        - Use units to check the work
        - Use dimensional analysis in converting units
- Scientific Notation
    - Digits *10 to a power
- Measurements
    - All measurement has some limit to their precision. Only estimate one digit further than the level of precision inherent in the instrument
    - Estimated digit (Uncertain Digit): The last digit given for any measurement
- Significant Figures
    - The valid digits in a measurement are called significant digits
    - Last digit in a measurement = estimated/uncertain digit
    - The significant digits: all the measured digits + one estimated digits
    - Show how precise the measurement is
        - Non zero digits, zeros between other digits, trailing decimal zero (allowed)
        - Leading zero (not allowed) Trailing zero (may or may not)
- Adding & Subtracting
    - Deform the operation
    - Round the results to have as many decimal places as the measured number with the smallest number of decimal numbers

1-2:

- Measurement is a comparison between an unknown quantity and a standard
  - Ex: measuring a leaf with a ruler:
    - Unknown quantity is length of the leaf
    - Standard is the meter
  - Repeated measurements are more reliable results
- Accuracy vs. Precision
  - Accuracy is the closeness of the measured values to the true value
    - Describes how well the results of a measurement agree with the real value
  - Precision is the closeness of the measured values to each other
  - True value is the standard or reference of known value or theoretical value
  - Precision is the degree of exactness of a measurement
    - Depends on the instrument and technique used
    - Finer division, more significant digits, more precise
    - Precision of a measurement is the half of the smallest division
- Instrument Limit of Error and Least Count
  - Least count is the smallest division that is marked on the instrument
    - Ex. Meter stick: 1.0mm
    - Ex. A digital stop watch: 0.01s
  - Instrument limit of error
    - Generally: least count or 1/2 of least count
    - Analogue reading devise: 1/2 of least count
    - Digital reading device: least count
- Techniques of good measurement
  - Scales should be read with one's eyes directly at which an instrument is read
  - The difference in the readings is caused by parallax, which is the apparent shift in the position of an object when it is viewed from different angles
- Uncertainty
  - The variation in measured data

- Uncertainty is the error
    - However, sometimes error is a value and uncertainty are a range
- Uncertainty is 1 significant figure
- (Measured value +/- uncertainty) unit

1-3:

- Variables
    - Independent variable: x in y=f(x)
        - The factor that is changed during experiment
    - Dependent variable: y in y=f(x)
        - The factor that depends on the independent variable
    - Bar chart is the only certain fixed values
    - Line graph is the only continuous range of values
- Graphs
    - Straight Line graph – Linear relationship
        - y=mx+b
    - Straight line graph from origin – Directly proportional
    - Curved graph – Quadratic Relationship
        - y=ax2+bx+c, a not 0
        - Parabola shape
    - Curved graph – Inverse Relationship
        - y=a/x
        - Hyperbola shape

5-1:

- Trigonometry
    - Sin = opposite/hypotenuse
    - Cos = base/hypotenuse
    - Tan = opposite/base
    - Vector resolution: A=Ax + Ay

- sin θ = Asin θ
- cos θ = Acos θ
- θ = tan_-1 (Ay/Ax)
- Rx = Ax+Bx+Cx
- Ry = Ay+By+Cy
- R = ✓Rx2+Ry2

5-2:

- What is Friction?
  - Friction is a resistance force that shows things down and tries to stoop objects sliding past each other
  - Friction always acts in the opposite direction to which object is moving or trying to move and parallel to the surface
- What causes Friction?
  - Friction occurs between two objects because the surface of those objects is rough
    - Roughness causes friction
- Types of Friction
  - Kinetic Friction: opposed to the motion, exerted on one surface by another when the two surfaces rub against each other from moving
  - Static Friction: It is exerted on one surface by another when there is no motion between two surfaces
    - Ffs = -Fapplied
- What does a Frictional Force Depend on?
  - The material of the surface
  - The normal force between two objects
- Equation for Kinetic Friction
  - The slope must be related to the magnitude of the resulting frictional force
    - Microk is called the coefficient of kinetic friction roughness of surface
    - Ffk = microk*Fn
- Equation for Static Friction

    - There is a limit to how large the static friction force can be. Once the force is greater than this maximum static friction, the object begins moving and kinetic friction begins to act on it instead of static friction
    - The static friction force acts in response to a force trying to cause a stationary object to start moving
- Coefficient of friction between various surface
    - Coefficients of friction can also be bigger than 1
    - Ms > Mks