Physics

Spring Semester Study Guide

Topics/Units covered:

* Unbalanced Forces
* Inverse Square Laws
	+ Coulomb’s Law (electrostatics)
	+ Universal Law of Gravitation
* Mechanical Energy
* Thermodynamics
* Impulse Momentum
* Wave and Energy Transfer
	+ Mechanical Waves
	+ Electromagnetic Waves
	+ Optics
* Electric Circuits

Formulas and Vocabulary Review:

1. Unbalanced Forces

Concept Ideas and Vocabulary

|  |  |  |  |
| --- | --- | --- | --- |
| Net Force | Static Friction | Kinetic Friction | Coefficient of Static Friction |
| Coefficient of Kinetic Friction | Inertia | Mass | Weight |
| Force | Free Body Diagrams |

Formulas

|  |  |
| --- | --- |
| Equation | Terminology |
| $$ΣF=F\_{net}=ma$$ | $F\_{net=}$the sum of all of the forces, m= mass, a= acceleration |
| $$F\_{g}=mg=Weight$$ | $F\_{g}=$the gravitational force, g=10 /s2 |
| $$F\_{s}=μ\_{s}F\_{n}$$ | Fs= static friction, µs= the coefficient of static friction, FN= Normal Force |
| $$F\_{k}=μ\_{k}F\_{n}$$ | Fk= kinetic friction, µk= the coefficient of kinetic friction, FN= Normal Force |

1. Inverse-Square Laws

Concept Ideas and Vocabulary:

|  |  |  |
| --- | --- | --- |
| Universal Law of Gravitation | Coulomb’s Law | Gravitational Field |
| Gravitational Field Lines | Electric Field | Electric Field Lines |
| Separating the distance between masses(charges) causes what effect on the force | Increasing/ decreasing the magnitude between masses (charges) causes what effect on the force |
| Induction | Conduction | Friction |
| Charge  | Mass | Gravitational Field Strength |
| Conservation of Charge |  |  |

Formulas:

|  |  |  |
| --- | --- | --- |
| Name of Equation | Equation | Constants |
| Universal Law of Gravitation | $$F\_{g}=G\frac{m\_{1}m\_{2}}{r^{2}}$$ | $$G=6.67x10^{-11} N\frac{m^{2}}{kg^{2}}$$ |
| Coulomb’s Law | $$F\_{k}=k\frac{q\_{1}q\_{2}}{d^{2}}$$ | $$K=9 x 10^{9} N\frac{m^{2}}{C^{2}}$$ |
| Gravitation Field Strength | $$g=G\frac{M}{r^{2}}$$ |  |

1. Impulse Momentum

Concept Ideas and Vocabulary

|  |  |  |
| --- | --- | --- |
| Impulse | Momentum | Impulse Momentum Theorem |
| Conservation of Momentum | Newton’s Third Law | Change in Velocity |

Formulas:

|  |  |
| --- | --- |
|  | Formula |
| Initial momentum = final momentum | pi=pf |
| Momentum | p=mv |
| Change in momentum | p=mΔV |
| Impulse | J=FΔt |
| Impulse=change in momentum | FΔt= mΔv |

1. Mechanical Energy

Concept Ideas and Vocabulary

|  |  |  |
| --- | --- | --- |
| Conservation of Energy | Gravitational Potential Energy | Kinetic Energy |
| Dissipated Energy | Elastic Energy | Spring Force |
| Work | Work Energy Theorem | Power |

Formulas:

|  |  |
| --- | --- |
| Formula Name | Equation |
| Work Energy Theorem | Work=Δ Energy |
| Work | W=Fd |
| Spring Force | Fs=kΔx |
| Elastic Energy | Eel=$\frac{1}{2}$kΔx2 |
| Kinetic Energy | Ek=$\frac{1}{2}$mv2` |
| Gravitational Potential Energy | Eg=mgh |
| Power | P=w/t |

1. Thermodynamics

Concept Ideas and Vocabulary

|  |  |  |
| --- | --- | --- |
| 0th -3rd Laws of Thermodynamics | Heat  | Temperature |
| Entropy | Thermal Energy | Potential Energy |
| Internal Energy | Conservation of Energy | Absolute Zero |
| Celsius | Fahrenheit  | Conduction |
| Convection | Radiation |  |

1. Mechanical Waves

Concept Ideas and Vocabulary

|  |  |  |
| --- | --- | --- |
| Amplitude | Constructive Interference | Destructive interference |
| Mechanical Wave | Longitudinal Wave | Transverse Wave |
| Frequency  | Wavelength | Period |
| Resonance | Doppler Effect | Crest |
| Trough | Sonic Boom | Medium |
| Compression | Rarefaction | Beats |
| Node | Anti-node | Standing wave |

Equations:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Formulas: | T=1/f | f=1/T | v=fλ | v=λ/T |

1. Electromagnetic Waves and Optics

Concept Ideas and Vocabulary

|  |  |  |
| --- | --- | --- |
| Angle of incidence | Angle of refraction | Angle of reflection |
| Reflection | Refraction | Dispersion |
| Diffraction | Total internal reflection | Polarization |
| Normal line | Diffuse reflection | Specular reflection |
| Law of Reflection | Concave mirror | Concave (diverging) Lens |
| Convex mirror | Convex (converging) Lens | FST |
| SFA | Critical Angle  | Real image |
| Virtual image | Huygens’ Principal  | Doppler Effect |

Equations:

|  |  |  |
| --- | --- | --- |
| Formula | Constant’s Name | Constants Numerical Value |
| $$v=λf$$ |  |  |
| $$c=λf$$ | c= speed of light | c= 3 x108 m/s  |
| $$E=hf$$ | h= plank’s constant | h=6.626 x 10-34 J•s  |
| $$E=\frac{hc}{λ}$$ |  |  |
| $$n=\frac{c}{v}$$ | n= index of refraction  |  |

1. Electricity

Concept Ideas and Vocabulary

|  |  |  |
| --- | --- | --- |
| Potential Difference (voltage)  | Current | Resistance |
| Power | Charge | Series circuits |
| Parallel circuits  |  |  |

Formulas:

|  |  |
| --- | --- |
| **EQUATIONS** | **VARIABLES & UNITS** |
| PE = qV | Potential Energy | PE = potential energy in Joules, q = charge in Coulombs, V= potential difference in Volts |
| I = q / t | Current | I = current in Amps, q = charge in Coulombs, t = time in seconds |
| V = IR | Ohm’s Law | V = potential difference in Volts, I = current in Amps, R = resistance in Ohms (Ω) |
| P = IV | Watt’s Law | P = power in Watts, I = current in Amps, V = potential difference in Volts |