

(CONCEPTUAL) PHYSICS A – STUDY GUIDE

The Chapter and Figure (diagram or picture) references are from the course textbook *Conceptual Physics* by Paul G. Hewitt.

Chapter 1 – About Science

Scientific Method: 1) Recognize a problem, 2) Make a hypothesis about the answer, 3) Use the hypothesis to make a prediction, 4) Test the prediction with experiments, 5) Create a general rule that organizes the results.

Vocabulary: **hypothesis, experiment, prediction, theory, scientific principle, scientific law**

Chapter 2 – Linear Motion

Table: 2.2, Figure: 2.6

Formulas: speed = (distance)/(time) $v = d/t$, distance = (speed)(time) $d = vt$,
acceleration = (change in speed)/(time) $a = \Delta v/t$, speed = (acceleration)(time) $v = at$,
distance = (1/2)(acceleration)(time)² $d = \frac{1}{2} at^2$
speed units = (meters)/(seconds) = **m/s**, acceleration units = (meters)/(seconds)² = **m/s²**
acceleration of gravity = $g = 9.8 \text{ m/s}^2$ [approximately: $g \sim 10 \text{ m/s}^2$]

Vocabulary: **speed, average speed, instantaneous speed, velocity, acceleration, free fall**

Chapter 3 – Projectile Motion

Figures: 3.6, 3.8, 3.9, 3.13, 3.16

Vocabulary: **projectile, vector, component**

Chapter 4 – Newton's First Law of Motion – Inertia

Figure: 4.8, 4.11

Vocabulary: **inertia, mass, weight, force, net force, newton**

Chapter 5 – Newton's Second Law of Motion – Force and Acceleration

Figures: 5.6, 5.11, 5.12

Formulas: force = (mass)(acceleration) $F = ma$, acceleration = (force)/(mass) $a = F/m$
weight = (mass)(acceleration of gravity) $F = mg$,
force units = newton = (kilogram)(meter)/second² $N = \text{kg m/s}^2$

Vocabulary: **friction, air resistance**

Chapter 6 – Newton's Third Law of Motion – Action and Reaction

Figures: 6.5, 6.6, 6.7, 6.9

Vocabulary: **action force, reaction force**

Chapter 7 – Momentum

Figures: 7.3, 7.4, 7.7, 7.8

Formulas: momentum = (mass)(velocity) $p = mv$, impulse = (force)(time) = Ft ,
Impulse = change in momentum $Ft = \Delta(mv)$ [usually $Ft = m \Delta v$]

Vocabulary: **momentum, impulse, conservation of momentum**

Chapter 8 – Energy

Figures: 8.3, 8.7, 8.8

Formulas: work = (force)(distance) $W = Fd$, power = (work)/(time) = (energy)/(time)

gravitational potential energy = (weight)(height) $PE = mgh$,

kinetic energy = (1/2)(mass)(speed)² $KE = \frac{1}{2}mv^2$

energy units = joule = (kilogram)(meter)²/(second)² $J = kg\ m^2/s^2$

power units = watt = (joule)/(second) $W = J/s$

Vocabulary: **work, power, mechanical energy, potential energy, kinetic energy, joule, watt, conservation of energy, efficiency**

Chapter 9 – Circular Motion

Figures: 9.1, 9.5, 9.7, 9.9, “Water-Bucket Swing”

Formulas: centripetal force = (mass)(tangential speed)²/(radius) $F = mv^2/r$

Vocabulary: **rotation, revolution, tangential speed, rotational speed, centripetal force**

Chapter 10 – Center of Gravity

Figures: 10.2, 10.4, 10.18, 10.24

Vocabulary: **center of gravity, center of mass, stability, stable equilibrium**

Chapter 11 – Rotational Mechanics

Figures: 11.4, 11.5, 11.9, 11.10, 11.15, 11.17, 11.26

Formulas: torque = (perpendicular force)(lever arm) $\tau = F_{\perp} r$,

Vocabulary: **torque, rotational inertia, conservation of angular momentum**

Chapter 12 – Universal Gravitation

Figures: 12.4, 12.11

Formulas: gravitational force = (gravitational constant)(mass one)(mass two)/(distance)² $F = Gm_1m_2/d^2$

Vocabulary: **universal gravitational constant, inverse-square law**

Chapter 13 – Gravitational Interactions

Figures: 13.6, 13.12, 13.13, 13.19

Vocabulary: **tide, weightlessness, black hole**

Chapter 14 – Satellite Motion

Figures: 14.3, 14.13

Formulas: orbital speed = $\sqrt{(\text{gravitational constant})(\text{mass of central body})/(\text{radius of orbit})}$ $v_{\text{orbit}} = \sqrt{Gm/r}$

Vocabulary: **orbital speed**

Chapters 15 & 16 – Special Relativity [next semester after the California Standards Tests]

Properties of Matter

Chapter 17 – *The Atomic Nature of Matter*

Figures: 17.7

Concepts: atoms are recyclable (17.2), atoms are small (17.3)

Vocabulary: **atom, molecule, electron, nucleus, nucleon, proton, neutron**

Chapter 18 – *Solids*

Figures: 18.2

Formulas: density = (mass)/(volume) **$d = m/V$**

Vocabulary: **crystal, density**

Chapter 19 – *Liquids*

Figures: 19.2, 19.3, 19.4, 19.5, 19.8, 19.15

Formulas: pressure = (force)/(area) **$P = F/A$**

pressure at the bottom of a liquid = (density)(acceleration of gravity)(depth) **$P = dgh$**

pressure units = pascal = newton/(meter)² **$Pa = N/m^2$**

Vocabulary: **pressure, buoyant force, displacement**

Chapter 20 – *Gases*

Figures: 20.2, 20.7, 20.8, 20.17, 20.18

Vocabulary: **barometer, Bernoulli's principle, lift**