

**PHYSICS 30**  
**COURSE OUTLINE**  
**Fairview High School**  
**Sept. 2021 – Jan. 2022**

**INSTRUCTOR:** Mrs. A. Laue, [lauea@prsd.ab.ca](mailto:lauea@prsd.ab.ca)

**RESOURCES:** Pearson; *PHYSICS*: Pearson Education Canada, 2007,  
*PHYSICS 30 Student Notes and Problems (SNAP)*, Castle Rock  
Research Corp., 2008

Website: [PhysicsSource](http://PhysicsSource)  
Login Name: fhsphysics2030  
Password: coolcobra1

**COURSE OVERVIEW:**

Physics 30 (5 credits) is intended to further students' understanding and application of fundamental physics concepts and skills. The focus of the course is on understanding the physics principles behind the natural events that students experience and the technology that they use in their daily lives. It develops knowledge, skills, and attitudes to help students become capable of and committed to setting goals, making informed choices, and acting in ways that will improve their own lives as well as life in their communities.

Students will study momentum and impulse, explain how momentum is conserved when objects interact and apply their understanding to safety and sports equipment. Students will describe the motion of electric charges and its relevance to magnetic fields, and they'll analyze the benefits and risks of electromagnetic technologies, such as magnetic resonance imaging and generators. They will use the wave and photon models of light to describe electromagnetic radiation and to better understand electromagnetic phenomena, including the photoelectric effect and electron diffraction. Students will also study the atom—its internal structure and energy—to understand matter, energy, and our universe.

**PHYSICS 30 OUTLINE:**

UNIT	TOPIC	CLASSES	APPROX. TIMELINE
A.	Momentum & Impulse	14	Aug. 30 – Sept. 17
B.	Forces and Fields	23	Sept. 21 – Oct. 26
C.	Electromagnetic Radiation	22	Oct. 27 – Nov. 30
D.	Atomic Physics	22	Dec. 1 – Jan. 14

## ASSESSMENT:

The Diploma Exam will be written on **Thursday, January 27, 2022** and is worth 30% of your final grade in Physics 30. Your course work makes up the other 70% and is calculated as follows.

School Mark:	70%	Unit Exams
	30%	Quizzes, Labs, and Assignments

## GENERAL EXPECTATIONS:

- **REGULAR ATTENDANCE** – Attendance is one of the most important factors for academic success. If an absence is unavoidable, it is YOUR responsibility to catch up on work that you missed. Please make arrangements with me or a classmate to obtain missed materials. If you miss a test due to an excused absence, you may write the test at lunch or in class on the first day back.
- **ARRIVE ON TIME** – When the bell goes, I expect you to be in your desk, with your books open, ready to start class. If lateness is unavoidable, please enter the classroom with a minimum of disruption.
- **COME PREPARED** – Please bring books, pencils, calculators, etc. to class *each* day. All calculations should be done in **pencil**. Handouts, quizzes, assignments, notes and exams are to be kept in order in a binder. These will assist you as a study guide.
- **ASSIGNMENTS** – All assignments are due at the **beginning of class**, on or before the due date.
- **WORK HABITS** – It is expected that students use class time to the best of their abilities for the whole period every class. I expect everyone to be listening when I am providing instruction. Please raise your hand and ask questions at any time during the class. Mature, respectful behaviour is a necessity for all members of the class.
- **SAFETY** – To ensure the safety of you and others, persons misbehaving or not following instructions given in the laboratory will be suspended from the laboratory and lose credit (marks) for the activity.

## GOALS

NO ONE CAN PREDICT TO WHAT HEIGHTS YOU CAN SOAR,  
EVEN YOU WILL NOT KNOW UNTIL YOU SPREAD YOUR  
WINGS.

**My goal for PHYSICS 30 is \_\_\_\_\_ %.**

## **PHYSICS 30 - OUTLINE**

### **Unit A: Momentum and Impulse** – Chapter 9

#### **General Outcome 1**

*Students will* explain how momentum is conserved when objects interact in an isolated system.

#### **Specific Outcomes for Knowledge**

*Students will:*

- ☐ 30–A1.1k define momentum as a vector quantity equal to the product of the mass and the velocity of an object
- ☐ 30–A1.2k explain, quantitatively, the concepts of impulse and change in momentum, using Newton’s laws of motion
- ☐ 30–A1.3k explain, qualitatively, that momentum is conserved in an isolated system
- ☐ 30–A1.4k explain, quantitatively, that momentum is conserved in one- and two-dimensional interactions in an isolated system
- ☐ 30–A1.5k define, compare and contrast elastic and inelastic collisions, using quantitative examples, in terms of conservation of kinetic energy.

### **Unit B: Forces and Fields** – Chapter 10, 11, & 12

#### **General Outcome 1**

*Students will* explain the behaviour of electric charges, using the laws that govern electrical interactions.

#### **Specific Outcomes for Knowledge**

*Students will:*

- ☐ 30–B1.1k explain electrical interactions in terms of the law of conservation of charge
- ☐ 30–B1.2k explain electrical interactions in terms of the repulsion and attraction of charges
- ☐ 30–B1.3k compare the methods of transferring charge (conduction and induction)
- ☐ 30–B1.4k explain, qualitatively, the distribution of charge on the surfaces of conductors and insulators
- ☐ 30–B1.5k explain, qualitatively, the principles pertinent to Coulomb’s torsion balance experiment
- ☐ 30–B1.6k apply Coulomb’s law, quantitatively, to analyze the interaction of two point charges
- ☐ 30–B1.7k determine, quantitatively, the magnitude and direction of the electric force on a point charge due to two or more other point charges in a plane
- ☐ 30–B1.8k compare, qualitatively and quantitatively, the inverse square relationship as it is expressed by Coulomb’s law and by Newton’s universal law of gravitation.

## General Outcome 2

*Students will* describe electrical phenomena, using the electric field theory.

### Specific Outcomes for Knowledge

*Students will:*

- ☐ 30–B2.1k define vector fields
- ☐ 30–B2.2k compare forces and fields
- ☐ 30–B2.3k compare, qualitatively, gravitational potential energy and electric potential energy
- ☐ 30–B2.4k define electric potential difference as a change in electric potential energy per unit of charge
- ☐ 30–B2.5k calculate the electric potential difference between two points in a uniform electric field
- ☐ 30–B2.6k explain, quantitatively, electric fields in terms of intensity (strength) and direction, relative to the source of the field and to the effect on an electric charge
- ☐ 30–B2.7k define electric current as the amount of charge passing a reference point per unit of time
- ☐ 30–B2.8k describe, quantitatively, the motion of an electric charge in a uniform electric field
- ☐ 30–B2.9k explain, quantitatively, electrical interactions using the law of conservation of energy
- ☐ 30–B2.10k explain Millikan's oil-drop experiment and its significance relative to charge quantization.

## General Outcome 3

*Students will* explain how the properties of electric and magnetic fields are applied in numerous devices.

### Specific Outcomes for Knowledge

*Students will:*

- ☐ 30–B3.1k describe magnetic interactions in terms of forces and fields
- ☐ 30–B3.2k compare gravitational, electric and magnetic fields (caused by permanent magnets and moving charges) in terms of their sources and directions
- ☐ 30–B3.3k describe how the discoveries of Oersted and Faraday form the foundation of the theory relating electricity to magnetism
- ☐ 30–B3.4k describe, qualitatively, a moving charge as the source of a magnetic field and predict the orientation of the magnetic field from the direction of motion
- ☐ 30–B3.5k explain, qualitatively and quantitatively, how a uniform magnetic field affects a moving electric charge, using the relationships among charge, motion, field direction and strength, when motion and field directions are mutually perpendicular
- ☐ 30–B3.6k explain, quantitatively, how uniform magnetic and electric fields affect a moving electric charge, using the relationships among charge, motion, field direction and strength, when motion and field directions are mutually perpendicular
- ☐ 30–B3.7k describe and explain, qualitatively, the interaction between a magnetic field and a moving charge and between a magnetic field and a current-carrying conductor
- ☐ 30–B3.8k explain, quantitatively, the effect of an external magnetic field on a current-carrying conductor
- ☐ 30–B3.9k describe, qualitatively, the effects of moving a conductor in an external magnetic field, in terms of moving charges in a magnetic field.

## Unit C: Electromagnetic Radiation – Chapter 13 & 14

### General Outcome 1

*Students will* explain the nature and behaviour of EMR, using the wave model.

#### Specific Outcomes for Knowledge

*Students will:*

- ☐ 30–C1.1k describe, qualitatively, how all accelerating charges produce EMR
- ☐ 30–C1.2k compare and contrast the constituents of the electromagnetic spectrum on the basis of frequency and wavelength
- ☐ 30–C1.3k explain the propagation of EMR in terms of perpendicular electric and magnetic fields that are varying with time and travelling away from their source at the speed of light
- ☐ 30–C1.4k explain, qualitatively, various methods of measuring the speed of EMR
- ☐ 30–C1.5k calculate the speed of EMR, given data from a Michelson-type experiment
- ☐ 30–C1.6k describe, quantitatively, the phenomena of reflection and refraction, including total internal reflection
- ☐ 30–C1.7k describe, quantitatively, simple optical systems, consisting of only one component, for both lenses and curved mirrors
- ☐ 30–C1.8k describe, qualitatively, diffraction, interference and polarization
- ☐ 30–C1.9k describe, qualitatively, how the results of Young's double-slit experiment support the wave model of light
- ☐ 30–C1.10k solve double-slit and diffraction grating problems using,  $\lambda = \frac{xd}{nl}$ ,  $\lambda = \frac{d \sin \theta}{n}$
- ☐ 30–C1.11k describe, qualitatively and quantitatively, how refraction supports the wave model of EMR, using  $\frac{\sin \theta_1}{\sin \theta_2} = \frac{n_2}{n_1} = \frac{v_1}{v_2} = \frac{\lambda_1}{\lambda_2}$
- ☐ 30–C1.12k compare and contrast the visible spectra produced by diffraction gratings and triangular prisms.

### General Outcome 2

*Students will* explain the photoelectric effect, using the quantum model.

#### Specific Outcomes for Knowledge

*Students will:*

- ☐ 30–C2.1k define the photon as a quantum of EMR and calculate its energy
- ☐ 30–C2.2k classify the regions of the electromagnetic spectrum by photon energy
- ☐ 30–C2.3k describe the photoelectric effect in terms of the intensity and wavelength or frequency of the incident light and surface material
- ☐ 30–C2.4k describe, quantitatively, photoelectric emission, using concepts related to the conservation of energy
- ☐ 30–C2.5k describe the photoelectric effect as a phenomenon that supports the notion of the wave-particle duality of EMR
- ☐ 30–C2.6k explain, qualitatively and quantitatively, the Compton effect as another example of wave-particle duality, applying the laws of mechanics and of conservation of momentum and energy to photons.

## **Unit D: Atomic Physics** – Chapter 15, 16, & 17

### **General Outcome 1**

*Students will* describe the electrical nature of the atom.

#### **Specific Outcomes for Knowledge**

*Students will:*

- ☐ 30–D1.1k describe matter as containing discrete positive and negative charges
- ☐ 30–D1.2k explain how the discovery of cathode rays contributed to the development of atomic models
- ☐ 30–D1.3k explain J. J. Thomson’s experiment and the significance of the results for both science and technology
- ☐ 30–D1.4k explain, qualitatively, the significance of the results of Rutherford’s scattering experiment, in terms of scientists’ understanding of the relative size and mass of the nucleus and the atom.

### **General Outcome 2**

*Students will* describe the quantization of energy in atoms and nuclei.

#### **Specific Outcomes for Knowledge**

*Students will:*

- ☐ 30–D2.1k explain, qualitatively, how emission of EMR by an accelerating charged particle invalidates the classical model of the atom
- ☐ 30–D2.2k describe that each element has a unique line spectrum
- ☐ 30–D2.3k explain, qualitatively, the characteristics of, and the conditions necessary to produce, continuous line-emission and line-absorption spectra
- ☐ 30–D2.4k explain, qualitatively, the concept of stationary states and how they explain the observed spectra of atoms and molecules
- ☐ 30–D2.5k calculate the energy difference between states, using the law of conservation of energy and the observed characteristics of an emitted photon
- ☐ 30–D2.6k explain, qualitatively, how electron diffraction provides experimental support for the de Broglie hypothesis
- ☐ 30–D2.7k describe, qualitatively, how the two-slit electron interference experiment shows that quantum systems, like photons and electrons, may be modelled as particles or waves, contrary to intuition.

### **General Outcome 3**

*Students will* describe nuclear fission and fusion as powerful energy sources in nature.

#### **Specific Outcomes for Knowledge**

*Students will:*

- ☐ 30–D3.1k describe the nature and properties, including the biological effects, of alpha, beta and gamma radiation
- ☐ 30–D3.2k write nuclear equations, using isotope notation, for alpha, beta-negative and beta-positive decays, including the appropriate neutrino and antineutrino
- ☐ 30–D3.3k perform simple, nonlogarithmic half-life calculations
- ☐ 30–D3.4k use the law of conservation of charge and mass number to predict the particles emitted by a nucleus
- ☐ 30–D3.5k compare and contrast the characteristics of fission and fusion reactions
- ☐ 30–D3.6k relate, qualitatively and quantitatively, the mass defect of the nucleus to the energy released in nuclear reactions, using Einstein’s concept of mass-energy equivalence.

#### General Outcome 4

Students will describe the ongoing development of models of the structure of matter.

#### Specific Outcomes for Knowledge

Students will:

- ☐ 30–D4.1k explain how the analysis of particle tracks contributed to the discovery and identification of the characteristics of subatomic particles
- ☐ 30–D4.2k explain, qualitatively, in terms of the strong nuclear force, why high-energy particle accelerators are required to study subatomic particles
- ☐ 30–D4.3k describe the modern model of the proton and neutron as being composed of quarks
- ☐ 30–D4.4k compare and contrast the up quark, the down quark, the electron and the electron neutrino, and their antiparticles, in terms of charge and energy (mass-energy)
- ☐ 30–D4.5k describe beta-positive ( $\beta^+$ ) and beta-negative ( $\beta^-$ ) decay, using first-generation elementary fermions and the principle of charge conservation (Feynman diagrams are not required).

#### TEACHING METHODOLOGY:

Students will be taught through a variety of different instructional methods and strategies including, but not limited to: lecture, question and answer discussion, small group work, independent learning, individual tutorials, laboratory work, demonstrations, and technological means including the use of a Smartboard, videos, online tools, and where appropriate personal owned devices.

#### ELECTRONIC DEVICES:

- Cell phones and other electronic devices may only be used at times indicated by the teacher. Please refrain from using them to make calls or text message during class time. If used inappropriately, they will be placed in the main office.
- All electronic devices must be placed on the teacher's desk during quizzes and exams.

**\*\*\* Regular attendance and consistent work habits are the key to your success. Extra help is available at noon hour and it is your responsibility to ask. IF you do your homework, review your work, study for quizzes/exams, you should be successful in Physics 30! Your success depends on YOU!!! Have a great semester and have fun!☺**

Please keep track of your marks as they will be posted weekly online.☺  
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