

Physics 30



Far out in the uncharted backwaters of the unfashionable end of the Western Spiral arm of the Galaxy lies a small unregarded yellow sun. Orbiting this at a distance of roughly ninety-eight million miles is an utterly insignificant little blue-green planet whose ape-descended life forms are so amazingly primitive that they still think digital watches are a pretty neat idea...

[The Hitch-Hikers Guide To The Galaxy]

Peace River High School

Sept. 2011

Mr. M.W. Ladd

Laddm@prsd.ab.ca

Physics 30 Course Outline

This is a very demanding course. You must be prepared to work extensively on your own if you wish to succeed. At least half of the work you do will be self-driven. You must do the material as it is assigned or you will fall behind and not be able to catch up. Marking will be on cumulative basis. Weightings for course work are:

70%-80% from test, quizzes etc...

20%-30% for work done during the unit i.e.: labs, assignments

Physics 20 review Sept 1,2

Unit Value(time percentage)

Unit A	15% Unit Exam on Sept 21
Unit B	30% Unit Exam on Oct 31
Unit C	30% Unit Exam on Dec 6
Unit D	25% Unit Exam on Jan 23

(The dates above are approximate, firm test dates will be announced at least one week prior, if you can't make a test I MUST be informed prior to the test! Call the school @ 624-4221 and leave a message for me prior to 8:30 AM. Failure to do this will result in a zero.)

Remember, this is a Diploma course and as such 50 % of your mark comes from a Government of Alberta exam written in January. The other 50 % comes from your course work. Therefore, missing even one test during class may cause failure! The format for the diploma is: You will write one multiple choice/numerical response exam.

There will also be several (5 or so) short essays that will be assigned during the term. You are expected to write a proper essay, form, grammar etc..., will be marked. All essays are to be typed. The plagiarism policy will be strictly enforced.

There are also several computer labs that you will do. The due dates will be given as the labs are assigned.

Take the time to search the Alberta Education web site. On there you can find the Physics 30 Diploma Exam Bulletin. Please read it by Thanksgiving. It contains a lot of very important info.

Probably the most important skill in this course is the ability to infer relationships between, variables, concepts etc... , and to equate one variable to another. This skill development requires a lot of reading, looking at relationships, and discussion. It's development will really help in developing your world view, so please do the reading as assigned, and do ask questions.

I am available most lunch hours for help. Please make an appointment with me a day or two before hand.

Mathematics and Science Directing Words

Discuss The word "discuss" **will not** be used as a directing word on math and science diploma examinations because it is not used consistently to mean a single activity.

The following words are specific in meaning.

Algebraically	Using mathematical procedures that involve letters or symbols to represent numbers
Analyze	To make a mathematical, chemical, or methodical examination of parts to determine the nature, proportion, function, interrelationship, etc. of the whole
Compare	Examine the character or qualities of two things by providing characteristics of both that point out their <i>similarities</i> and <i>differences</i>
Conclude	State a logical end based on reasoning and/or evidence
Contrast/Distinguish	Point out the <i>differences</i> between two things that have similar or comparable natures
Criticize	Point out the <i>demerits</i> of an item or issue
Define	Provide the essential qualities or meaning of a word or concept; make distinct and clear by marking out the limits
Describe	Give a written account or represent the characteristics of something by a figure, model, or picture
Design/Plan	Construct a plan; i.e, a detailed sequence of actions for a specific purpose
Determine	Find a solution, to a specified degree of accuracy, to a problem by showing appropriate formulas, procedures, and calculations
Enumerate	Specify one by one or list in concise form and according to some order
Evaluate	Give the significance or worth of something by identifying the good and bad points or the advantages and disadvantages
Explain	Make clear what is not immediately obvious or entirely known; give the cause of or reason for; make known in detail

Graphically	Using a drawing that is produced electronically or by hand and that shows a relation between certain sets of numbers
How	Show in what manner or way, with what meaning
Hypothesize	Form a tentative proposition intended as a possible explanation for an observed phenomenon; i.e., a possible cause for a specific effect. The proposition should be testable logically and/or empirically
Identify	Recognize and select as having the characteristics of something
Illustrate	Make clear by giving an example. The form of the example must be specified in the question; i.e., word description, sketch, or diagram
Infer	Form a generalization from sample data; arrive at a conclusion by reasoning from evidence
Interpret	Tell the meaning of something; present information in a new form that adds meaning to the original data
Justify/Show How	Show reasons for or give facts that support a position
Model	Find a model (in mathematics, a model of a situation is a pattern that is supposed to represent or set a standard for a real situation) that does a good job of representing a situation
Outline	Give, in an organized fashion, the essential parts of something. The form of the outline must be specified in the question; i.e., list, flow chart, concept map
Predict	Tell in advance on the basis of empirical evidence and/or logic
Prove	Establish the truth or validity of a statement for the general case by giving factual evidence or logical argument
Relate	Show logical or causal connection between things
Sketch	Provide a drawing that represents the key features of an object or graph
Solve	Give a solution for a problem; i.e., explanation in words and/or numbers
Summarize	Give a brief account of the main points
Trace	Give a step-by-step description of the development
Verify	Establish, by substitution for a particular case or by geometric comparison, the truth of a statement
Why	Show the cause, reason, or purpose

Science Process Words

- Hypothesis:** A single proposition intended as a possible explanation for an observed phenomenon; e.g., a possible cause for a specific effect
- Conclusion:** A proposition that summarizes the extent to which a hypothesis and/or a theory has been supported or contradicted by the evidence
- Experiment:** A set of manipulations and/or specific observations of nature that allow the testing of hypotheses and/or generalizations
- Variables:** Conditions that can change in an experiment. Variables in experiments are categorized as:
- *manipulated variables* (independent variables)
—conditions that were deliberately changed by the experimenter
 - *controlled variables* (fixed or restrained variables) — conditions that could have changed but did not, because of the intervention of the experimenter
 - *responding variables* (dependent variables)
—conditions that changed in response to the change in the manipulated variables
- Technology:** The development of our understanding of science is directly related to the development of technology. The meaning of technology has many facets, but in general, technology refers to a method or process for handling a specific practical problem. This includes the development of tools and new techniques for solving problems. It also includes ideas and their organization for achieving practical purposes. In the context of an examination question, technology includes both these facets of meaning. That is, a technological explanation should include not only identification and descriptions of equipment (tools, products) but also explanations of procedures.

Guidelines for Significant Digits, Manipulation of Data, and Rounding for Science Diploma Examinations

Significant Digits (measured values)

1. For all non-logarithmic values, regardless of decimal position, any of the digits 1 to 9 is a significant digit; 0 may be significant. For example:

123 0.123 0.00230 2.30×10^3 2.03
all have 3 significant digits

2. Leading zeros are not significant. For example:

0.12 and 0.012 each have two significant digits

3. **The Learner Assessment Branch considers all trailing zeros to be significant.** For example:

200 has three significant digits
0.123 00 and 20.000 each have five significant digits

4. For logarithmic values such as pH, any digit to the left of the decimal is **not** significant. For example:

a pH of 1.23 has two significant digits
a pH of 7 has no significant digits

Manipulation of Data

1. When adding or subtracting measured quantities, the calculated answer should be rounded to the same degree of precision as that of the least precise number used in the computation **if this is the only operation.** For example in the following addition:

12.3 (least precise)
 0.12
12.34
24.76

The answer should be rounded to 24.8.

2. When multiplying or dividing measured quantities, the calculated answer should be rounded to the same number of significant digits as are contained in the quantity with the fewest number of significant digits **if this is the only operation**. For example:

$$(1.23)(54.321) = 66.81483$$

The answer should be rounded to 66.8.

3. When a series of calculations is performed, each interim value should not be rounded before carrying out the next calculation. The final answer should then be rounded to the same number of significant digits as are contained in the quantity in the **original data** with the fewest number of significant digits. For example:

In determining the value of $(1.23)(4.321) \div (3.45 - 3.21)$, three calculations are required:

- a. $3.45 - 3.21 = 0.24$
- b. $(1.23)(4.321) = 5.31483$
- c. $5.31483 \div 0.24 = 22.145125$
[Not $5.31 \div 0.24 = 22.125$]

The value should be rounded to 22.1.

Note: In the example given, steps *a* and *b* yield interim values. These values should not be used in determining the number of significant digits.

4. When calculations involve exact numbers (counted and defined values) the calculated answer should be rounded based upon the precision of the measured value(s). For example:

$$12 \text{ eggs} \times 52.3 \text{ g/egg} = 627.6 \text{ g}$$

or

$$5 \text{ mol} \times 32.06 \text{ g/mol} = 160.30 \text{ g}$$

or

$$1 \text{ mol} (-1095.8 \text{ kJ/mol}) + 2 \text{ mol} (40.8 \text{ kJ/mol}) = -1014.2 \text{ kJ}$$

Rounding

1. When the first digit to be dropped is less than or equal to 4, the last digit retained should not be changed. For example:

1.2345 rounded to three digits is 1.23

2. When the first digit to be dropped is greater than or equal to 5, the last digit retained should be increased by one. For example:

12.25 rounded to three digits is 12.3



Computer Labs

This semester you will do quite a number of simulations using a computer demo package. Most of the labs you will just complete. Some you will need to print off and hand in. I will let you know which they are and the due date. All the Labs can be found at <http://www.learnalberta.ca/Home.aspx>. Search by Grade (12), Subject (Science) Keyword (physics). Refine your search by picking (experiments) from the drop down list.

Physics 30

A Brief Synopsis

Unit A Momentum and Impulse.

1. explain how momentum is conserved when objects interact in an isolated system

Key Concepts

- impulse
- momentum
- Newton's laws of motion
- elastic collisions
- inelastic collisions

Unit B Forces and Fields

1. explain the behaviour of electric charges, using the laws that govern electrical interactions

2. describe electrical phenomena, using the electric field theory

3. explain how the properties of electric and magnetic fields are applied in numerous devices.

Key Concepts

- electric charge
- conservation of charge
- Coulomb's law
- vector fields
- electric field
- magnetic field
- electric potential difference
- interaction of charges with electric and magnetic fields
- charge quantization—Millikan's experiment
- electromagnetic induction

Unit C Electromagnetic Radiation

1. explain the nature and behavior of EMR, using the wave model
2. explain the photoelectric effect, using the quantum model.

Key Concepts

- speed of EMR
- propagation of EMR
- reflection
- refraction
- diffraction
- interference
- total internal reflection
- Snell's law
- photoelectric effect
- Compton effect

Unit D Atomic Physics

1. describe the electrical nature of the atom
2. describe the quantization of energy in atoms and nuclei
3. describe nuclear fission and fusion as powerful energy sources in nature
4. describe the ongoing development of models of the structure of matter.

Key Concepts

- charge-to-mass ratio (Thomson's experiment)
- classical model of the atom (Rutherford, Bohr)
- spectra: continuous, line emission and line absorption
- energy levels (states)
- de Broglie hypothesis
- quantum mechanical model
- half-life
- nuclear decay
- nuclear reactions
- Standard Model of matter