

1 | Science Skills

IB Physics Content Guide

Big Ideas

- Units are an arbitrary construct invented by humans to communicate quantitative measurements
- All units can be made up of the 7 Fundamental SI Units
- Metric prefixes and scientific notation can be used to make large or small values easier to communicate
- Units can cancel out when being divided by like units
- Unit analysis can be used to determine the validity of a formula or determine the unit of an unknown solution
- No measurement or calculation from measurement is exact. There is a certain range of uncertainty

Content Objectives

1.2 – Units

I can describe the difference between quantitative and qualitative observations			
I can identify the 7 Fundamental SI units			
I can define and give an example of a derived unit			
I can represent fractional units with negative exponents			
I can convert metric units between prefixes			

1.3 – Dimensional Analysis

I can convert fraction units and exponential units using Dimensional Analysis			
I can use dimensional analysis to verify a formula			
I can use dimensional analysis to determine the units for a solution			
I can represent large and small numbers using scientific notation			
I can compare quantities by orders of magnitude			

1.4 – Uncertainty

I can define and compare the terms precision and accuracy			
I can define and compare random and systematic error			
I can report a measurement to the appropriate level of precision (decimal places)			
I can report a measurement with the proper uncertainty for the instrumentation used			
I can determine the number of significant digits in a reported value			

1.5 – Uncertainty in Calculations

I can calculate the uncertainty of an average taken from repeated measurements			
I can define and calculate absolute, fractional, and percent uncertainty			
I can determine the uncertainty when adding or subtracting two numbers			
I can determine the uncertainty when multiplying or dividing two numbers			

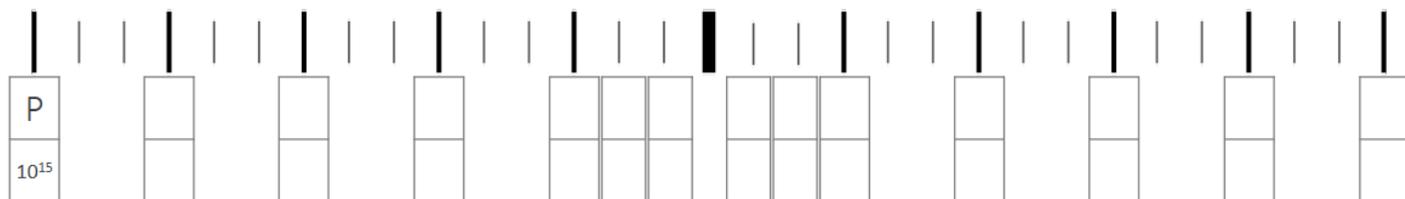
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Shelving Guide

List the seven fundamental base units and their abbreviations:

	Unit	Abbreviation
Length		
Mass		
Time		
Electric Current		
Temperature		
Amount of Substance		
Luminous Intensity		

Metric Prefixes – List the unit prefixes in their appropriate decimal position



Dimensional Analysis

Convert the following:

$$20 \text{ mi hr}^{-1} \rightarrow \text{m s}^{-1}$$

$$0.0007 \text{ km}^2 \rightarrow \text{m}^2$$

Determine the units for Q:

Q = mc ΔT	m (mass)	kg
	c (specific heat)	J kg ⁻¹ K ⁻¹
	ΔT (change in temp)	K

Error and Measurements

Define the following terms:

Precision	Accuracy
Random Error	Systematic Error

Record the rules for recording measurements to the proper precision and uncertainty:

	Measurement Precision	Measurement Uncertainty
Analog		
Digital		

**the precision in the measurement and uncertainty MUST match*

Significant Digits

1. All zeros between non-zero digits are significant
2. Filler zeros to the left of an understood decimal place are not significant.
3. Filler zeros to the right of a decimal place are not significant.
4. All non-filler zeros to the right of a decimal place are significant.

IB grading will award full credit for answers within 1 significant digit of the actual so **round to 3 significant digits**

Uncertainty

Absolute Uncertainty:	<i>Data Booklet Equations:</i>	
Fractional Uncertainty:	If: $y = a \pm b$ Then: $\Delta y = \Delta a + \Delta b$	
Percentage Uncertainty:	If: $y = \frac{ab}{c}$ Then: $\frac{\Delta y}{y} = \frac{\Delta a}{a} + \frac{\Delta b}{b} + \frac{\Delta c}{c}$	