**Numbers, Units and Mechanics**

**Pre-Class Activities**

**Working with Numbers**

As science communicators, you will often have to include highly specific information in your written materials. For example, you might be writing a lab report in which you will provide numerical details about the method you used in your experiment, or you might wish to simplify complex sentences with abbreviations to make your text less clunky. There are some rules to follow if you want to do this effectively and achieve your basic goal of enhancing the readability of your work.

In a few cases, you might have to make a judgment call as to which rule should be followed; when working with numbers especially, there are sometimes occasions when rules from different style guides clash. Having said this, if you plan your work with clarity in mind, most sentences can be simplified to follow the important, universally accepted rules. When this is not possible, you should follow the one golden rule: **Always be consistent in your style**.

**Some Basic Rules**

1. Do not start a sentence with a numeral (e.g. write ‘Seventy’, not ‘70’)
2. Use numerals when writing about counted items, percentages, decimals, magnifications, and official scales (e.g. write: ‘We caught 27 mice, which we estimated to make up 40% of the local population. These data suggest there are 520 mice per km2. We viewed mouse hairs under a microscope at 40x magnification. These hairs measured 3.4 on the Rodent Hair Thickness scale.’)
3. Spell small numbers (e.g. write: ‘One, two, three’, all the way to nine)
4. Use numerals for larger numbers (e.g. use ‘10, 11, 12’ etc.)
5. Make much larger numbers easier to read with commas and periods; if a number has four or more digits, separate them with a comma and do this for every three numbers in the sequence (e.g. 2,546,457). If the number has six or more digits and it is appropriate to be slightly less accurate, simplify it further by using a period and the following format: ‘Approximately 2.5 million.’
6. Avoid having two distinct numbers next to one another, sometimes by using a mixture of writing and numbers (e.g. write: ‘We tested 15 different 19-year-olds’ or: ‘We tested fifteen 19-year-olds’, not ‘we tested 15 19-year-olds’)
7. Spell official names and true nouns (e.g. write about the ‘First’ Law of Thermodynamics, not the ‘1st’ Law)

**Always remember the golden rule of being consistent in your style.** If two rules clash in one sentence, you will have to favour one over the other. Make sure you continue to favour that one over the other throughout your text.

**Question 1 (5 marks)**

Read the sentences below and pay attention to the **five** numerical-based errors, which have been **bolded** for you. Copy and paste the sentences and then edit the **bolded** sections to remove the errors (1 mark each). *Hint: Use the basic rules above to help you.*

In the year 526 AD, the **3rd** most deadly earthquake of all time struck Antioch and killed approximately **250000** people. **20,000** fewer people were killed in 2004 by a tsunami caused by a quake in the Indian Ocean. Scientists believe an earthquake in the 1960s was the worst ever in terms of its magnitude; it measured **nine point five** on the Richter scale. After a quake occurs, the plates of the earth’s crust that are involved can continue to ‘fault’ for hours afterwards. Time lag between faults can range from 30 seconds to **ten** minutes, with major faulting able to cause the planet to vibrate by as much as 1 cm.

**Question 2 (5 marks)**

There are **five** numerical-based errors in total in the paragraphs below, but they have not been highlighted for you this time; try to find and edit them appropriately (1 mark each). **Bold** the changes you make so it is easy to see what you changed. *Hint: Use the basic rules above to help you. Do not make more than five changes or you will be penalized!*

An independent scientific review panel recently concluded that the death of over one hundred whales, which became stranded on a beach, was caused by sonar testing in the ocean. Many beach strandings in the past 30 years have been blamed on sonar tests but a lack of complete evidence meant the link was indefinite.

Scientists have used data from beached whales to estimate population sizes of certain species around the world. Although this has been 1 small benefit to come from a distressing spectacle, it was very sad that spade-toothed beaked whales had to die for scientists to get their first ever close-up look at them. Three partial skeletons in over one hundred and forty years had been all there was to go on, before two individuals beached in New Zealand in 2010. Measuring approximately five metres in length, these whales were initially mistaken for a different, more common species. 13 species only live off the coast of New Zealand, but it took DNA analysis to tell them apart from Gray’s beaked whales. Together, these two species make up fourteen % of the *Mesoplodont* whales, which are the most poorly known group of mammals alive.

**Questions 3, 4 and 5 (2 marks each, 6 marks total)**

Each of the following three questions feature sentences that are written awkwardly or in which there are competing style rules in play. For each sentence, you are told which rule you should follow to improve the clarity and will need to make **two** changes.

As you did in the earlier questions, copy and paste the sentences and edit the erroneous parts based on the rule you have been told to follow (2 marks for each question). Make sure you **bold** your changes.

**Question 3:** There were 1,156 tornadoes in the United States in 2009. Of these, there were 20 3-star magnitude twisters and 82 2-star magnitude twisters.

**To answer Question 3, follow the rule that states you should not write two distinct numbers next to each other (but leave the numbers attached to the star magnitude scale, as this is an official scale).**

**Question 4:** In the first month, six out of 10 reported tornadoes were confirmed whereas in the 12th month 48 out of 52 reported tornadoes were confirmed.

**To answer Question 4, follow the rule of consistency to use numbers for counts of one thing (tornadoes) and words for counts of another (months).**

**Question 5:** There was an approximate seven-fold increase in the number of tornadoes reported between the ninth and 10th months of 2009, but a 16-fold decrease between the 10th and 11th months.

**To answer Question 5, follow the rule of consistency to use numbers for counts of one thing (months) and words for comparisons of another (magnitudes).**

**Using abbreviations (and acronyms)**

Just as with numbers, there are multiple rules to learn about using abbreviations correctly. The good news is that these rules tend to be a little less ambiguous in terms of their application. There will still be occasions when you need to make a judgment call, but, as before, remember that the goals of consistency and clarity should guide you.

Acronyms work similarly to abbreviations (in a sense, they are a type of abbreviation). Acronyms are formed by using the first letters of each word in a phrase or compound word, whereas we usually think of abbreviations as shortened versions of a word or phrase. So, CIA is an acronym (for ‘Central Intelligence Agency), whereas ‘abbrev’ would be an abbreviation of ‘abbreviation’.

**Some Basic Rules**

With clarity in mind, a general rule of thumb is that you should abbreviate (make shorter) a particularly wordy phrase or compound word that will be used more than once in a body of text. For example, if you plan to mention the University of British Columbia more than once, it would be easier to digest as a reader if you use the acronym ‘UBC’. For abbreviations or acronyms that might not be widely known by members of the target audience, use them only **after** you have written the full form first. For example: The University of Washington (UW) is one of the best universities in Washington State. Over 40,000 students attend the Seattle campus of UW.

A few more general rules include:

1. Use a period, and shorten official titles before and after a person’s name (e.g. ‘Dr. Jones, Ph.D.’). Only use periods when a title has been shortened though.
2. Abbreviate common units of measurement (e.g. ‘g’ for grams, ‘kg’ for kilograms, ‘lb’ for pounds, ‘ml’ for millilitres, ‘ft’ for feet, ‘μg’ for micrograms etc.)
3. Abbreviate common latin terms (e.g. write ‘e.g.’ and ‘etc.’, not ‘*exempli gratia*’ and ‘*et cetera*’) but in scientific writing you should write the full name for a species the first time you write it before subsequently abbreviating the genus part of the name (e.g. ‘*E. coli*’ is only acceptable **after** you have told your audience that the ‘*E*’ stands for ‘*Escherichia*’).
4. Abbreviate very common words or phrases. Deciding whether something is sufficiently common can result in a judgment call, but a good rule of thumb is to ask whether someone would know what you mean if they have no specialist knowledge of your subject (e.g. it would be fine to say ‘TV’ rather than ‘television’, but it would not be fine to say ‘PCR’ instead of ‘polymerase chain reaction’ unless you were communicating with biochemists only).
5. Abbreviate very famous organizations or institutions, as well as compound-worded countries (e.g. ‘BBC’, ‘CNN’, ‘CIA’, ‘NATO’, ‘USA’, ‘UK’). Whether or not the acronym uses a period to separate letters is usually up to you, but be consistent in your style.
6. **Do not** abbreviate words at the beginning of a sentence unless they are common acronyms or abbreviations.
7. **Do not** abbreviate days or months in formal writing (e.g. use ‘Tuesday’ instead of ‘Tues’, and ‘February’ instead of ‘Feb’.
8. **Do not** abbreviate words as you might in text messaging style (e.g. do not write ‘lol’, ‘nite’, ‘omg’ etc.)

**Questions 6, 7, and 8 (1 mark each, 3 marks total)**

The following multiple-choice questions each feature four sentences (answers), of which only one is written in the correct style for acronyms and abbreviations. Try to select the correct one.

**Question 6:** You are writing the opening lines of an essay about your favourite charity.

A: Supporters of the National Center for Science Education campaign to have evolution and climate change taught extensively in schools.

B: Supporters of NCSE campaign to have evolution and climate change taught extensively in schools.

C: Supporters of the National Center for Science Education (NCSE) campaign to have evolution and climate change taught extensively in schools.

D: Supporters of NCSE (National Center for Science Education) campaign to have evolution and climate change taught extensively in schools.

**Question 7:** You are now talking about a bird that was part of a famous evolutionary case study.

A: The vegetarian finch (*Platyspiza crassirostris*) was one of the birds initially studied by Charles Darwin on the Galapagos Islands. *P. crassirostris* individuals primarily eat plants but do occasionally eat caterpillars.

B: The vegetarian finch (*Platyspiza crassirostris*) was one of the birds initially studied by Charles Darwin on the Galapagos Islands. *Platyspiza crassirostris* individuals primarily eat plants but do occasionally eat caterpillars.

C: *Platyspiza crassirostris* was one of the birds initially studied by Charles Darwin on the Galapagos Islands. Vegetarian finch (*Platyspiza crassirostris)* individuals primarily eat plants but do occasionally eat caterpillars.

D: *Platyspiza crassirostris* was one of the birds initially studied by Charles Darwin on the Galapagos Islands. Vegetarian finch (*P. crassirostris)* individuals primarily eat plants but do occasionally eat caterpillars.

**Question 8:** Now you are discussing how technology has aided evolutionary studies.

A: DNA studies have recently shown that ‘Darwin’s finches’ are actually all tanagers.

B: DNA (Deoxyribonucleic acid) studies have recently shown that ‘Darwin’s finches’ are actually all tanagers.

C: Deoxyribo Nucleic Acid (DNA) studies have recently shown that ‘Darwin’s finches’ are actually all tanagers.

D: Deoxyribonucleic acid studies have recently shown that ‘Darwin’s finches’ are actually all tanagers.

**Questions 9, 10, and 11 (2 marks each, 6 marks total)**

Consider the three sentences below (one for each question). Each one features **one** abbreviation or acronym-based error.

Copy and paste each sentence and then **bold** the error in each one (1 mark). Then copy and paste the sentence again but re-write it appropriately (1 mark). Make sure you **bold** your changes. *Hint: Use the basic rules above to help you.*

**Question 9:** Professor Reilly studies ‘ring species’ such as herringgulls (*Larus spp.*). Her conservation-conscious colleague, Thomas Deane, MSc, finds it fascinating how only gulls from the more closely linked populations around the globe can interbreed.

**Question 10:** Herring gulls that comprise the populations making up this ring can be seen along the coasts of UK, USA and CAN throughout the year.

**Question 11:** These gulls can measure up to 26 inches (66 cm) long and typically weigh between 1.5 and 3.5 lb.