**Numbers, Unit 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 1.5 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.

**Questions 1, 2, 3, 4, 5, 6 and 7 (2 marks each, 14 marks total)**

Listed below are seven (not 7) sentences (one for each question). Each sentence contains **one** numerical-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). *Hint: Use the basic rules above to help you.* ***Bold*** *the edits in your re-written sentences.*

**Question 1:** In 1831 Charles Darwin set out on a voyage of discovery with another 72 crewmembers aboard the HMS Beagle; the trip would last 1737 days and would ultimately revolutionize the way we think about the adaptation and evolution of species.

**Question 2:** While in the city of Valdivia, Chile, a major earthquake struck. It was estimated to measure a devastating eight point five on the Richter scale, yet experts believe there have been at least 14 deadlier quakes in human history.

**Question 3:** In the year 526, the 3rd most deadly quake of all time struck Antioch and killed approximately 250,000 people.

**Question 4:** 230,000 people were killed in 2004 by the tsunami that resulted from a quake in the Indian Ocean. Thirty-metre waves crushed everything in their path.

**Question 5:** The quake had the longest time lag between faulting (this was between 8.3 and ten minutes). This caused the planet to vibrate by as much as 1 cm.

**Question 6:** However, in terms of magnitude, the Great Chilean Earthquake that occurred in Valdivia in the nineteen sixties was the worst ever. It measured 9.5 on the Richter scale, which is set to a logarithmic scale.

**Question 7:** 44% of 394 experts polled in a recent study believe it is impossible for a quake to measure more than 9.7 on the Richter scale.

**Questions 8, 9 and 10 (4 marks each, 12 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 **bold** the parts that must be changed (2 marks for each question). Then copy and paste the sentences again before re-writing them (and **bolding** the edits) based on the rule you have been told to follow (2 marks for each question).

**Question 8:** 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.

**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 9:** 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.

**Follow the rule of consistency to use numbers for counts of one thing (tornadoes) and words for counts of another (months).**

**Question 10:** 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 month.

**Follow the rule of consistency to use numbers for counts of one thing (months) and words for comparisons of 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 11, 12, 13 and 14 (1 mark each, 4 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 11:** You are writing the opening lines of an essay about your favourite charity.

A: Supporters of the Marine Life Sanctuaries Society of BC continue to discourage fishermen from taking rockfish from conservation areas

B: Supporters of MLSS continue to discourage fishermen from taking rockfish from conservation areas

C: Marine Life Sanctuaries Society of BC (MLSS) supporters continue to discourage fishermen from taking rockfish from conservation areas

D: Supporters of MLSS (Marine Life Sanctuaries Society of BC) continue to discourage fishermen from taking rockfish from conservation areas

**Question 12:** You are now providing information about a very rare species.

A: Black rockfish (*Sebastes melanops*) eat small fish. *S. melanops* individuals shoal together and are very aggressive feeders.

B: Black rockfish (*Sebastes melanops*) eat small fish. *Sebastes melanops* individuals shoal together and are very aggressive feeders.

C: Black rockfish (*S. melanops*) eat small fish. *S. melanops* individuals shoal together and are very aggressive feeders.

D: *Sebastes melanops* eat small fish, shoal together, and are very aggressive feeders.

**Question 13:** You are beginning to talk about the status of this species.

A: According to Dr Siegel, black rockfish were very common in Puget Sound 50 years ago but divers rarely report seeing them now.

B: According to Dr. Siegel, black rockfish were very common in Puget Sound 50 years ago but divers rarely report seeing them now.

C: According to Doctor Siegel, black rockfish were very common in Puget Sound 50 years ago but divers rarely report seeing them now.

D: According to Doctor. Siegel, black rockfish were very common in Puget Sound 50 years ago but divers rarely report seeing them now.

**Question 14:** You are discussing the breeding structure of black rockfish populations.

A: SCUBA divers attached tracking devices to individuals and these showed that fish disperse wide distances to mate.

B: SCUBA (Self-Contained Underwater Breathing Apparatus) divers attached tracking devices to individuals and these showed that fish disperse wide distances to mate.

C: Self-Contained Underwater Breathing Apparatus (SCUBA) divers attached tracking devices to individuals and these showed that fish disperse wide distances to mate.

D: Self-Contained Underwater Breathing Apparatus divers attached tracking devices to individuals and these showed that fish disperse wide distances to mate.

**Questions 15, 16, 17, 18 and 19 (2 marks each, 10 marks total)**

Consider the five 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 (**bolding** your edits, 1 mark). *Hint: Use the basic rules above to help you.*

**Question 15:** Mr. Thompson says killer whales (*Orcinus orca*) are his favourite animals, but his conservation-conscious daughter, Miss. Thompson, prefers gray whales (*Eschrictius robustus*).

**Question 16:** According to the World Wildlife Fund (WWF), one distinct population of gray whales is critically endangered. *E. robustus* individuals in this population only number around 100 at present.

**Question 17:** *Eschrictius robustus* individuals are most likely to be seen along the west coast of USA and CAN as they migrate south between October and December.

**Question 18:** Although many taxonomists believe that these whales are the only surviving members of their evolutionary family, deoxyribonucleic acid (DNA) studies suggest humpback whales (*Megaptera novaeangliae)* are more closely related to them than they are to minke whales (*Balaenoptera acutorostrata*), which are currently classified in the same family.

**Question 19:** The International Whaling Commission (the IWC) recently estimated there to be 1 million minke whales in different populations around the world; however, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) believe some populations are at risk.