Cheat sheet for writing a scientific manuscript

Structure of the manuscript

Each *s*entence should make a clear statement or ask a clear question. Give specific examples.
Bad: To overcome the given limitations of standard VMI, one can modify the set-up in several ways: ...
Better: Traditional implementations of VMI can only detect low-velocity particles. Several modifictions are required to detect high-velocity (> 1 keV) ions: ...

Each paragraph should address one topic or question. Every paragraph should make sense without the need to read the complete manuscript. You should be able to define a subject for each paragraph.
E.g.: "Ionization of matter with XUV radiation", "Spectrometers to characterize ionized particles", "Velocity map imaging spectrometers", ...

Each Figure Illustrates an important premise, result, or model. The reader should quickly grasp the content of the figure and figure caption without reading the complete manuscript. Make sure all elements and font are large enough (hold your graph at 1 m distance, now you know what the shortsighted referee will see.) 'A picture is worth a thousand words.' (is yours?)

Each section of the text fulfills a well-defined role

Abstract (write this at last)
The abstract should accurately reflect the content of the paper.

Introduction (write this after the Discussion)
Define the question you will address in the text.
Why is this question scientifically relevant, why should the reader be interested?
What has been done to address the question in the past? (Avoid discussing marginally relevant literature.)
Describe related work that will help you answer your question.

Experimental / Theoretical (write this first)
Describe the experiment or theoretical work you performed. A skilled reader should be able to reproduce your work based on the information you give -- write no more and no less.

Results (write this after the Experimental / Theoretical section)
Describe the experimental or theoretical results. If multiple experiments are presented, then clarify the differences between them. Describe the statistical analysis of the data. Do not dilute your results with conjecture or premature interpretation.

Discussion (write this after the Results section)
Explain how the data answers your scientific question. (If you have not yet identified your scientific question, then take a mental step back to identify what is new in your data and how it relates to the existing knowledge.) Refer to the literature to show whether your results agree, disagree, or complement published work. Give a model that explains your results and other published data. Collect all literature you require to interpret and model your data: you should introduce this literature in the Introduction. Now you can go and write the Introduction.

Conclusion (write this after the Discussion)
Consolidate the discussed results, judge their significance and speculate on future directions. Do not write Conclusions unless the Discussion is excessively long or, for other reasons, unintelligible.

Style and Grammar in the manuscript

Write short and descriptive sentences.
Never hide the subject of your sentence and stick to subject-predicate-object sentences whenever possible. Use precise language and avoid vague terms.
Bad: To be able to compare the capabilities of the VMI to measure the electron spectra of high kinetic energy particles, a simulation of the ionization of Xenon with a photon energy of 1200 eV is done. Better: A simulation modeled the energy resolution of our VMI under realistic experimental conditions. We simulated the ionization of xenon with 1200 eV photons.

Use the active tense
To compare the capabilities of the spectrometer, a simulation is done. --> A simulation modeled the capabilities of the spectrometer.

Remove unnecessary words and qualifiers
~~Much~~ better to ~~be able to~~ describe the ~~fundamental~~ importance in a ~~brief~~ summary.

Stay positive, avoid negation
Apart from fluoride, CTTS states are not accessible. --> CTTS states are only accessible in fluorides.
We show that also for fluoride, the excitation of the CTTS state does not play a role.
--> We show that excitation of the CTTS state is negligible even for fluorides.

Do not give opinions
The reader will not care what you can see in you data, whether you believe in a result, or what you think about the problem at hand. Use arguments, reasoning and evidence to persuade the reader.

Be precise, be specific
spectrometer capability --> energy resolution of the spectrometer.
High-energy radiation interacts with large molecules. --> 860 keV photons ionize 60 MDa proteins.

Stay scientific
Separate experimental observations (facts) from the interpretation (fiction). Be aware, that many models can explain the same observation. Decompose your scientific question into *Yes/No* options. Can your results answer those questions? A definite answer to a small question may be worth more than a vague answer to a big question. (The big questions belong into the Introduction and into your proposal!)

Check your subjects and verbs
Make sure the verb stands in proper relation to the Subject (singular/plural, context).
Repeller and extractor need~~s~~ to be biased. (Two subjects); To shorten the flight tube enhances the spectrometer. --> A shorter flight tube enhances the spectrometer. (Missing subject)

Put in the commas
Comma rules: http://bit.ly/wVhzAq (Capital Community College); http://bit.ly/wZfWau (Purdue U.).
Put a comma after: *However, ... (Introductory word); As last step, ... (Introductory element); Compared to the Parker VMI, ... (Introductory clause).*

Use Dictionaries and Spellcheckers
Dictionaries: **www.merriam-webster.com** (English), dict.leo.org (English-German)

Further reading

ACS Style Guide (http://bit.ly/xF7to8); AIP Style Manual (http://bit.ly/AdYsAC); From Research to Manuscript, Michael Jay Katz (2nd Ed., Springer 2009)); The Economist Style Guide.

Berlin, 3.2.2012,
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