Final Assignment notes

This is the main part of the assignment. It requires students to construct a model of their colony and to write a creative essay about it. Students usually need 1-2 weeks to complete this final assignment.

After completing the four preliminary assignments, most students have given a lot of thought to their projects and can write very impressive essays. Students should be encouraged to get creative with their essays, although straightforward reports are also acceptable. In the past, essays have taken the form of letters home to Earth, promotional brochures, chapters about space exploration from future text books, personal diaries, captain’s logs or reports to command centers.

Students should be encouraged to look through closets, basements, sheds, etc., for unused, small, oddball objects to use in constructing their models. The local recycling center can be an excellent place to get supplies for the students. Many centers save unusual objects for use as art or craft supplies that they give away to teachers, and they may be able to supply all the materials the students will need to build their models. Often students having a hard time getting started will get ideas just by looking at the supplies brought in by the teacher.

Astronomy Final Project

There are two parts to the final project.

The first part is a model of your space station/colony. You may use any materials you wish to represent your space colony. I will grade it according to the quality and creativity of the work, the amount of detail and information presented, and the amount of effort involved in producing it. I will also want your colony to be scientifically plausible, based on what we know about your planet. (You can not, for example, build igloos on Venus unless you figure out a way to keep the ice from melting.) Keep in mind that there is much that we do not yet know about many of the planets. Don’t be afraid to use your imagination to fill in the blanks. You may make reasonable assumptions. Just make sure that what you make up is consistent with the basic facts of your planet. Don’t go putting rings around Mars or giving extra moons to Pluto.

The second part is a 2 to 3 page written description of your space station/colony. This description may be in many different forms. It could be a series of letters to someone on Earth, a chapter out of a history book, a promotional brochure, a short story or comic book, or it could be a straightforward essay. Whatever form it takes, it must describe the different parts of the station and explain what they do. It should explain all the basic needs of the colonists and how these needs are provided. This essay also should reflect your knowledge of your planet and your knowledge of the difficulties of supporting human life in space. It may contain information already
presented on the four previous astronomy assignments. It may also contain
drawings or diagrams, and it may be handwritten or typed.

Other topics your report might address:
• History - When was the space station build? Were there any difficulties
constructing it?
• Purpose - Why was it built? What do the colonists hope to accomplish there?
• Goals - Is this space station part of a larger plan?
• Materials - What are the different parts made out of?
• New technologies - Where there any new inventions that helped in the
construction or functions of the colony?

This project is a combination of science and science fiction. You will
need to use your imagination as you construct and write about your colony or
space station. Use the following process as you complete your project:

1) Start with what you know about your planet;

2) Identify difficulties in supporting life on your planet.

Steps 1 and 2 should be scientifically accurate.

3) Devise solutions to these difficulties;

This is where you have to be creative. Make up solutions, invent new
technologies, but do not resort to “magic” or constant restocking of supplies
from Earth. You may, however, trade with other nearby planets or moons if
both places have things the other place needs. The more scientifically plausible
your solutions are, the higher your grade will be.

4) Incorporate these solutions into your project;

This is the science fiction part. Use your imagination, and don’t be afraid
to dream!

This project is due on _______________.

It is important that students know how their projects will be evaluated. About a
week before the due date give the students the evaluation guide (Appendix B) so they
know what to expect when their projects are graded. It is almost identical to the form the
students receive their final grade on (Appendix C). Appendices D and E contain the same
forms, respectively, for teachers that allow their students to choose either a model or a
poster as their project.

There are 115 points possible with this assignment. This means that students can
get up to 15 points extra credit. The advantage of this approach is that teachers can point out areas of strength and weakness without severely impacting the grade. Full credit in a particular area denotes outstanding achievement. With a project this big, it is unlikely that a student will be outstanding in every area. This method allows instructors to point out ways the project could be improved and still give a high grade to reflect the effort a student has put into the project. It should be very rare for a student to get 115 points, but an excellent project often gets between 95 and 110 points. However, if a teacher finds this approach objectionable, the grading forms are easily modifiable.
Appendix A

Standards Addressed

Benchmarks (Grades 3 through 5)

1A – The Scientific World View
Results of similar scientific investigations seldom turn out exactly the same. Sometimes this is because of unexpected differences in the things being investigated, sometimes because of unrealized differences in the methods used or in the circumstances in which the investigation is carried out, and sometimes just because of uncertainties in observations. It is not always easy to tell which.

1B – Scientific Inquiry
Scientific investigations may take many different forms, including observing what things are like or what is happening somewhere, collecting specimens for analysis, and doing experiments. Investigations can focus on physical, biological, and social questions.

1C – The Scientific Enterprise
Science is an adventure that people everywhere can take part in, as they have for many centuries.

Clear communication is an essential part of doing science. It enables scientists to inform others about their work, expose their ideas to criticism by other scientists, and stay informed about scientific discoveries around the world.

Doing science involves many different kinds of work and engages men and women of all ages and backgrounds.

3A – Technology and Science
Technology enables scientists and others to observe things that are too small or too far away to be seen without them and to study the motion of objects that are moving very rapidly or are hardly moving at all.

Measuring instruments can be used to gather accurate information for making scientific comparisons of objects and events and for designing and constructing things that will work properly.

Technology extends the ability of people to change the world: to cut, shape, or put together materials; to move things from one place to another; and to reach farther with their hands, voices, senses, and minds. The changes may be for survival needs such as food, shelter, and defense, for communication and transportation, or to gain knowledge and express ideas.

3B – Design and Systems
There is no perfect design. Designs that are best in one respect (safety or ease of use, for example) may be inferior in other ways (cost or appearance). Usually some features must be sacrificed to get others. How such trade-offs are received depends upon which features are emphasized and which are down-played.
Even a good design may fail. Sometimes steps can be taken ahead of time to reduce the likelihood of failure, but it cannot be entirely eliminated.

The solution to one problem may create other problems.

3C – Issues in Technology
Scientific laws, engineering principles, properties of materials, and construction techniques must be taken into account in designing engineering solutions to problems. Other factors, such as cost, safety, appearance, environmental impact, and what will happen if the solution fails also must be considered.

Technologies often have drawbacks as well as benefits. A technology that helps some people or organisms may hurt others—either deliberately (as weapons can) or inadvertently (as pesticides can). When harm occurs or seems likely, choices have to be made or new solutions found.

4D – The Structure of Matter
When a new material is made by combining two or more materials, it has properties that are different from the original materials. For that reason, a lot of different materials can be made from a small number of basic kinds of materials.

4E – Energy Transformation
Things that give off light often also give off heat. Heat is produced by mechanical and electrical machines, and any time one thing rubs against something else.

Some materials conduct heat much better than others. Poor conductors can reduce heat loss.

5E – Flow of Matter and Energy
Some source of “energy” is needed for all organisms to stay alive and grow.

6A – Human Identity
Human beings have made tools and machines to sense and do things that they could not otherwise sense or do at all, or as quickly, or as well.

8B – Materials and Manufacturing
Naturally occurring materials such as wood, clay, cotton, and animal skins may be processed or combined with other materials to change their properties.

Through science and technology, a wide variety of materials that do not appear in nature at all have become available, ranging from steel to nylon to liquid crystals.

Discarded products contribute to the problem of waste disposal. Sometimes it is possible to use the materials in them to make new products, but materials differ widely in the ease with which they can be recycled.

8C – Energy Sources and Use
Moving air and water can be used to run machines.

11A – Systems
In something that consists of many parts, the parts usually influence one another.

Something may not work as well (or at all) if a part of it is missing, broken, worn out, mismatched, or misconnected.

11B – Models
Seeing how a model works after changes are made to it may suggest how the real thing would work if the same were done to it.

Geometric figures, number sequences, graphs, diagrams, sketches, number lines, maps, and stories can be used to represent objects, events, and processes in the real world, although such representations can never be exact in every detail.

12C – Manipulation and Observation
Choose appropriate common materials for making simple mechanical constructions and repairing things.

12D – Communication Skills
Make sketches to aid in explaining procedures or ideas.

Benchmarks (Grades 6 through 8)
1B – Scientific Inquiry
Scientists differ greatly in what phenomena they study and how they go about their work. Although there is no fixed set of steps that all scientists follow, scientific investigations usually involve the collection of relevant evidence, the use of logical reasoning, and the application of imagination in devising hypotheses and explanations to make sense of the collected evidence.

1C – The Scientific Enterprise
No matter who does science and mathematics or invents things, or when or where they do it, the knowledge and technology that result can eventually become available to everyone in the world.

3A – Technology and Science
Technology is essential to science for such purposes as access to outer space and other remote locations, sample collection and treatment, measurement, data collection and storage, computation, and communication of information.

Engineers, architects, and others who engage in design and technology use scientific knowledge to solve practical problems. But they usually have to take human values and limitations into account as well.

3B – Design and Systems
Design usually requires taking constraints into account. Some constraints, such as gravity or the properties of the materials to be used, are unavoidable. Other constraints, including economic, political, social, ethical, and aesthetic ones, limit choices.

All technologies have effects other than those intended by the design, some of which may have been predictable and some not. In either case, these side effects may turn out to be unacceptable to some of the population and therefore lead to conflict between groups.

Almost all control systems have inputs, outputs, and feedback. The essence of control is comparing information about what is happening to what people want to happen and then making appropriate adjustments. This procedure requires sensing information, processing it, and making changes. In almost all modern machines, microprocessors serve as centers of performance control.

Systems fail because they have faulty or poorly matched parts, are used in ways that exceed what was intended by the design, or were poorly designed to begin with. The most common ways to prevent failure are pretesting parts and procedures, overdesign, and redundancy.

3C – Issues in Technology
The human ability to shape the future comes from a capacity for generating knowledge and developing new technologies-and for communicating ideas to others.

Technology cannot always provide successful solutions for problems or fulfill every human need.

New technologies increase some risks and decrease others. Some of the same technologies that have improved the length and quality of life for many people have also brought new risks.

Societies influence what aspects of technology are developed and how these are used. People control technology (as well as science) and are responsible for its effects.

4E – Energy Transformation
Energy cannot be created or destroyed, but only changed from one form into another.

5E – Flow of Matter and Energy
Food provides molecules that serve as fuel and building material for all organisms. Plants use the energy in light to make sugars out of carbon dioxide and water. This food can be used immediately for fuel or materials or it may be stored for later use. Organisms that eat plants break down the plant structures to produce the materials and energy they need to survive. Then they are consumed by other organisms.

Over a long time, matter is transferred from one organism to another repeatedly and between organisms and their physical environment. As in all material systems, the total amount of matter remains constant, even though its form and location change.

6A – Human Identity
Technologies having to do with food production, sanitation, and disease prevention have dramatically changed how people live and work and have resulted in rapid increases in the human population.

8B – Materials and Manufacturing
The choice of materials for a job depends on their properties and on how they interact with other materials. Similarly, the usefulness of some manufactured parts of an object depends on how well they fit together with the other parts.

Manufacturing usually involves a series of steps, such as designing a product, obtaining and preparing raw materials, processing the materials mechanically or chemically, and assembling, testing, inspecting, and packaging. The sequence of these steps is also often important.

Automation, including the use of robots, has changed the nature of work in most fields, including manufacturing. As a result, high-skill, high-knowledge jobs in engineering, computer programming, quality control, supervision, and maintenance are replacing many routine, manual-labor jobs. Workers therefore need better learning skills and flexibility to take on new and rapidly changing jobs.

8C – Energy Sources and Use
Energy can change from one form to another, although in the process some energy is always converted to heat. Some systems transform energy with less loss of heat than others.

Different ways of obtaining, transforming, and distributing energy have different environmental consequences.

In many instances, manufacturing and other technological activities are performed at a site close to an energy source. Some forms of energy are transported easily, others are not.

Electrical energy can be produced from a variety of energy sources and can be transformed into almost any other form of energy. Moreover, electricity is used to distribute energy quickly and conveniently to distant locations.

Energy from the sun (and the wind and water energy derived from it) is available indefinitely. Because the flow of energy is weak and variable, very large collection systems are needed. Other sources don’t renew or renew only slowly.

11A – Systems
Thinking about things as systems means looking for how every part relates to others. The output from one part of a system (which can include material, energy, or information) can become the input to other parts. Such feedback can serve to control what goes on in the system as a whole.

Any system is usually connected to other systems, both internally and externally. Thus a system may be thought of as containing subsystems and as being a subsystem of a larger system.

11B – Models
Models are often used to think about processes that happen too slowly, too quickly, or on too small a scale to observe directly, or that are too vast to be changed deliberately, or that are potentially dangerous.

Benchmarks (Grades 9 through 12)
1A – The Scientific World View
Scientists assume that the universe is a vast single system in which the basic rules are the same everywhere. The rules may range from very simple to extremely complex, but scientists operate on the belief that the rules can be discovered by careful, systematic study.

3A – Technology and Science
Mathematics, creativity, logic and originality are all needed to improve technology.

Technology usually affects society more directly than science because it solves practical problems and serves human needs (and may create new problems and needs). In contrast, science affects society mainly by stimulating and satisfying people's curiosity and occasionally by enlarging or challenging their views of what the world is like.

3B – Design and Systems
In designing a device or process, thought should be given to how it will be manufactured, operated, maintained, replaced, and disposed of and who will sell, operate, and take care of it. The costs associated with these functions may introduce yet more constraints on the design.

Complex systems have layers of controls. Some controls operate particular parts of the system and some control other controls. Even fully automatic systems require human control at some point.

The more parts and connections a system has, the more ways it can go wrong. Complex systems usually have components to detect, back up, bypass, or compensate for minor failures.

To reduce the chance of system failure, performance testing is often conducted using small-scale models, computer simulations, analogous systems, or just the parts of the system thought to be least reliable.

4E – Energy Transformation
Transformations of energy usually produce some energy in the form of heat, which spreads around by radiation or conduction into cooler places. Although just as much total energy remains, its being spread out more evenly means less can be done with it.

5E – Flow of Matter and Energy
The amount of life any environment can support is limited by the available energy, water, oxygen, and minerals, and by the ability of ecosystems to recycle the residue of dead organic materials. Human activities and technology can change the flow and reduce the fertility of the land.
The chemical elements that make up the molecules of living things pass through food webs and are combined and recombined in different ways. At each link in a food web, some energy is stored in newly made structures but much is dissipated into the environment as heat. Continual input of energy from sunlight keeps the process going.

8B – Materials and Manufacturing
Waste management includes considerations of quantity, safety, degradability, and cost. It requires social and technological innovations, because waste-disposal problems are political and economic as well as technical.

Scientific research identifies new materials and new uses of known materials.

8C – Energy Sources and Use
At present, all fuels have advantages and disadvantages so that society must consider the tradeoffs among them.

11A – Systems
The successful operation of a designed system usually involves feedback. The feedback of output from some parts of a system to input of other parts can be used to encourage what is going on in a system, discourage it, or reduce its discrepancy from some desired value. The stability of a system can be greater when it includes appropriate feedback mechanisms.

Even in some very simple systems, it may not always be possible to predict accurately the result of changing some part or connection.

National Standards (Grades 5-8)
Transfer of Energy
Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound, nuclei, and the nature of a chemical. Energy is transferred in many ways.

Electrical circuits provide a means of transferring electrical energy when heat, light, sound, and chemical changes are produced.

Understandings about Science and Technology
Scientific inquiry and technological design have similarities and differences. Scientists propose explanations for questions about the natural world, and engineers propose solutions relating to human problems, needs, and aspirations. Technological solutions are temporary; technologies exist within nature and so they cannot contravene physical or biological principles; technological solutions have side effects; and technologies cost, carry risks, and provide benefits.

Science and technology are reciprocal. Science helps drive technology, as it addresses questions that demand more sophisticated instruments and provides principles for better instrumentation and technique. Technology is essential to science, because it provides instruments and techniques that enable observations of objects and phenomena that are otherwise unobservable.
due to factors such as quantity, distance, location, size, and speed. Technology also provides tools for investigations, inquiry, and analysis.

Perfectly designed solutions do not exist. All technological solutions have trade-offs, such as safety, cost, efficiency, and appearance. Engineers often build in back-up systems to provide safety. Risk is part of living in a highly technological world. Reducing risk often results in new technology.

Technological designs have constraints. Some constraints are unavoidable, for example, properties of materials, or effects of weather and friction; other constraints limit choices in the design, for example, environmental protection, human safety, and aesthetics.

Technological solutions have intended benefits and unintended consequences. Some consequences can be predicted, others cannot.

Science and Technology in Society
Technology influences society through its products and processes. Technology influences the quality of life and the ways people act and interact. Technological changes are often accompanied by social, political, and economic changes that can be beneficial or detrimental to individuals and to society. Social needs, attitudes, and values influence the direction of technological development.

Nature of Science
Scientists formulate and test their explanations of nature using observation, experiments, and theoretical and mathematical models. Although all scientific ideas are tentative and subject to change and improvement in principle, for most major ideas in science, there is much experimental and observational confirmation. Those ideas are not likely to change greatly in the future. Scientists do and have changed their ideas about nature when they encounter new experimental evidence that does not match their existing explanations.

National Standards (Grades 9-12)
Understandings about Scientific Inquiry
Scientists conduct investigations for a wide variety of reasons. For example, they may wish to discover new aspects of the natural world, explain recently observed phenomena, or test the conclusions of prior investigations or the predictions of current theories.

Scientists rely on technology to enhance the gathering and manipulation of data. New techniques and tools provide new evidence to guide inquiry and new methods to gather data, thereby contributing to the advance of science. The accuracy and precision of the data, and therefore the quality of the exploration, depends on the technology used.

Matter, Energy and Organization in Living Systems
The energy for life primarily derives from the sun. Plants capture energy by absorbing light and using it to form strong (covalent) chemical bonds between the atoms of carbon-containing (organic) molecules. These molecules can be used to assemble larger molecules with biological
activity (including proteins, DNA, sugars, and fats). In addition, the energy stored in bonds between the atoms (chemical energy) can be used as sources of energy for life processes.

Energy in the Earth System
Earth systems have internal and external sources of energy, both of which create heat. The sun is the major external source of energy. Two primary sources of internal energy are the decay of radioactive isotopes and the gravitational energy from the earth's original formation.

Understandings about Science and Technology
Creativity, imagination, and a good knowledge base are all required in the work of science and engineering.

Natural Resources
Human populations use resources in the environment in order to maintain and improve their existence. Natural resources have been and will continue to be used to maintain human populations.

Indiana Standards
Grade 5

**English/Language Arts** – Writing: Process
5.4.1 – Discuss ideas for writing, keep a list or notebook of ideas, and use graphic organizers to plan writing.

5.4.2 – Write stories with multiple paragraphs that develop a situation or plot, describe the setting, and include an ending.

5.4.3 Write informational pieces with multiple paragraphs that:
- present important ideas or events in sequence or in chronological order.
- provide details and transitions to link paragraphs.
- offer a concluding paragraph that summarizes important ideas and details.

Writing: Applications
5.5.3 Write research reports about important ideas, issues, or events by using the following guidelines:

Frame questions that direct the investigation.
Establish a main idea or topic.
Develop the topic with simple facts, details, examples, and explanations.
Use a variety of information sources, including firsthand interviews, reference materials, and electronic resources, to locate information for the report.

**Science** – Scientific Thinking
5.2.3 – Choose appropriate common materials for making simple mechanical constructions and repairing things.
5.3.10 – Investigate that some materials conduct heat much better than others, and poor conductors can reduce heat loss.

The Living Environment
5.4.4 – Explain that in any particular environment, some kinds of plants and animals survive well, some do not survive as well, and some cannot survive at all.

Common Themes
5.6.1 – Recognize and describe that systems contain objects as well as processes that interact with each other.

Models and Scale
5.6.2 – Demonstrate how geometric figures, number sequences, graphs, diagrams, sketches, number lines, maps, and stories can be used to represent objects, events, and processes in the real world, although such representation can never be exact in every detail.

Grade 6

English/Language Arts – Writing: Process
6.4.1 – Discuss ideas for writing, keep a list or notebook of ideas, and use graphic organizers to plan writing.

6.4.2 – Choose the form of writing that best suits the intended purpose.

6.4.3 – Write informational pieces of several paragraphs that:

- engage the interest of the reader.
- state a clear purpose.
- develop the topic with supporting details and precise language.
- conclude with a detailed summary linked to the purpose of the composition.

6.4.4 – Use a variety of effective organizational patterns, including comparison and contrast, organization by categories, and arrangement by order of importance or climactic order.

Writing: Writing Applications
6.5.2 – Write descriptions, explanations, comparison and contrast papers, and problem and solution essays that:

- state the thesis (position on the topic) or purpose.
- explain the situation.
- organize the composition clearly.
- offer evidence to support arguments and conclusions.

6.5.7 – Write for different purposes and to a specific audience or person, adjusting tone and style as necessary.

Science – The Nature of Science and Technology
6.1.7 – Explain that technology is essential to science for such purposes as access to outer space and other remote locations, sample collection and treatment, measurement, data collection and storage, computation, and communication of information.

The Physical Setting
6.3.17 – Recognize and describe that energy is a property of many objects and is associated with heat, light, electricity, mechanical motion, and sound.

Common Themes
6.7.2 – Use models to illustrate processes that happen too slowly, too quickly, or on too small a scale to observe directly, or are too vast to be changed deliberately, or are potentially dangerous.

Grade 7
English/Language Arts – Writing: Process
7.4.1 – Discuss ideas for writing, keep a list or notebook of ideas, and use graphic organizers to plan writing.

Writing: Writing Applications
7.5.7 – Write for different purposes and to a specific audience or person, adjusting style and tone as necessary.

Science – The Physical Setting
7.3.15 – Describe how electrical energy can be produced from a variety of energy sources and can be transformed into almost any other form of energy, such as light or heat.

7.3.16 – Recognize and explain that different ways of obtaining, transforming, and distributing energy have different environmental consequences.

Common Themes
7.7.2 – Use different models to represent the same thing, noting that the kind of model and its complexity should depend on its purpose.

Grade 8
English/Language Arts – Writing: Process
8.4.1 – Discuss ideas for writing, keep a list or notebook of ideas, and use graphic organizers to plan writing.

8.4.5 – Achieve an effective balance between researched information and original ideas.

Writing: Writing Applications
8.5.6 – Write using precise word choices to make writing interesting and exact.

8.5.7 – Write for different purposes and to a specific audience or person, adjusting tone and style as necessary.
English Language Conventions
8.6.4 – Edit written manuscripts to ensure that correct grammar is used.

8.6.5 – Use correct punctuation.

8.6.6 – Use correct capitalization.

8.6.7 – Use correct spelling conventions.

Science – The Nature of Science and Technology
8.1.6 – Identify the constraints that must be taken into account as a new design is developed, such as gravity and the properties of the materials to be used.

Common Themes
8.7.2 – Explain that even in some very simple systems, it may not always be possible to predict accurately the result of changing some part or connection.

8.7.4 – Explain that as the complexity of any system increases, gaining an understanding of it depends on summaries, such as averages and ranges*, and on descriptions of typical examples of that system.
Appendix B

Astronomy Final Project Grading Criteria

Model:
- Quality of construction (up to 10 points)
- Ingenuity of design (up to 10 points)
- Amount of detail (up to 10 points)
- Creative use of materials (up to 10 points)
- Aesthetics (up to 10 points)

Essay:
- Completeness of colony description (up to 10 points)
- Quality of writing, including:
  - Mechanics (up to 5 points)
  - Creativity of format (up to 5 points)
  - Presentation and neatness (up to 5 points)

Model and Essay together:
- Knowledge of planet or moon displayed (up to 10 points)
- Knowledge of available resources (up to 10 points)
- Ingenuity of solutions (up to 10 points)
- Scientific plausibility of colony (up to 10 points)
Appendix C

Astronomy Final Project Grading Criteria

Model:
- Quality of construction (up to 10 points) ______
- Ingenuity of design (up to 10 points) ______
- Amount of detail (up to 10 points) ______
- Creative use of materials (up to 10 points) ______
- Aesthetics (up to 10 points) ______

Essay:
-Completeness of colony description (up to 10 points) ______

Quality of writing, including:
  - Mechanics (up to 5 points) ______
  - Creativity of format (up to 5 points) ______
  - Presentation and neatness (up to 5 points) ______

Model and Essay together:
- Knowledge of planet or moon displayed (up to 10 points) ______
- Knowledge of available resources (up to 10 points) ______
- Ingenuity of solutions (up to 10 points) ______
- Scientific plausibility of colony (up to 10 points) ______

Total points: ______
Appendix D
Astronomy Final Project Grading Criteria

Model:
- Quality of construction (up to 10 points)
- Ingenuity of design (up to 10 points)
- Amount of detail (up to 10 points)
- Creative use of materials (up to 10 points)
- Aesthetics (up to 10 points)

Essay:
- Completeness of colony description (up to 10 points)
- Quality of writing, including:
  - Mechanics (up to 5 points)
  - Creativity of format (up to 5 points)
  - Presentation and neatness (up to 5 points)

Model and Essay together:
- Knowledge of planet or moon displayed (up to 10 points)
- Knowledge of available resources (up to 10 points)
- Ingenuity of solutions (up to 10 points)
- Scientific plausibility of colony (up to 10 points)
Appendix E

Astronomy Final Project Grade

Name: ______________________________

Model:
- Quality of construction (up to 10 points) ______
- Ingenuity of design (up to 10 points) ______
- Amount of detail (up to 10 points) ______
- Creative use of materials (up to 10 points) ______
- Aesthetics (up to 10 points) ______

or Poster:
- Quality of drawing (up to 10 points) ______
- Ingenuity of design (up to 10 points) ______
- Amount of detail (up to 10 points) ______
- Quality of labeling (up to 10 points) ______
- Layout and aesthetics (up to 10 points) ______

Essay:
- Completeness of colony description (up to 10 points) ______
- Quality of writing, including:
  - Mechanics (up to 5 points) ______
  - Creativity of format (up to 5 points) ______
  - Presentation and neatness (up to 5 points) ______

Model/Poster and Essay:
- Knowledge of planet or moon displayed (up to 10 points) ______
- Knowledge of available resources (up to 10 points) ______
- Ingenuity of solutions (up to 10 points) ______
- Scientific plausibility of colony (up to 10 points) ______

Total points: ______

Portions of this article were originally published by the Hoosier Science Teacher, 2004. Reprinted with permission