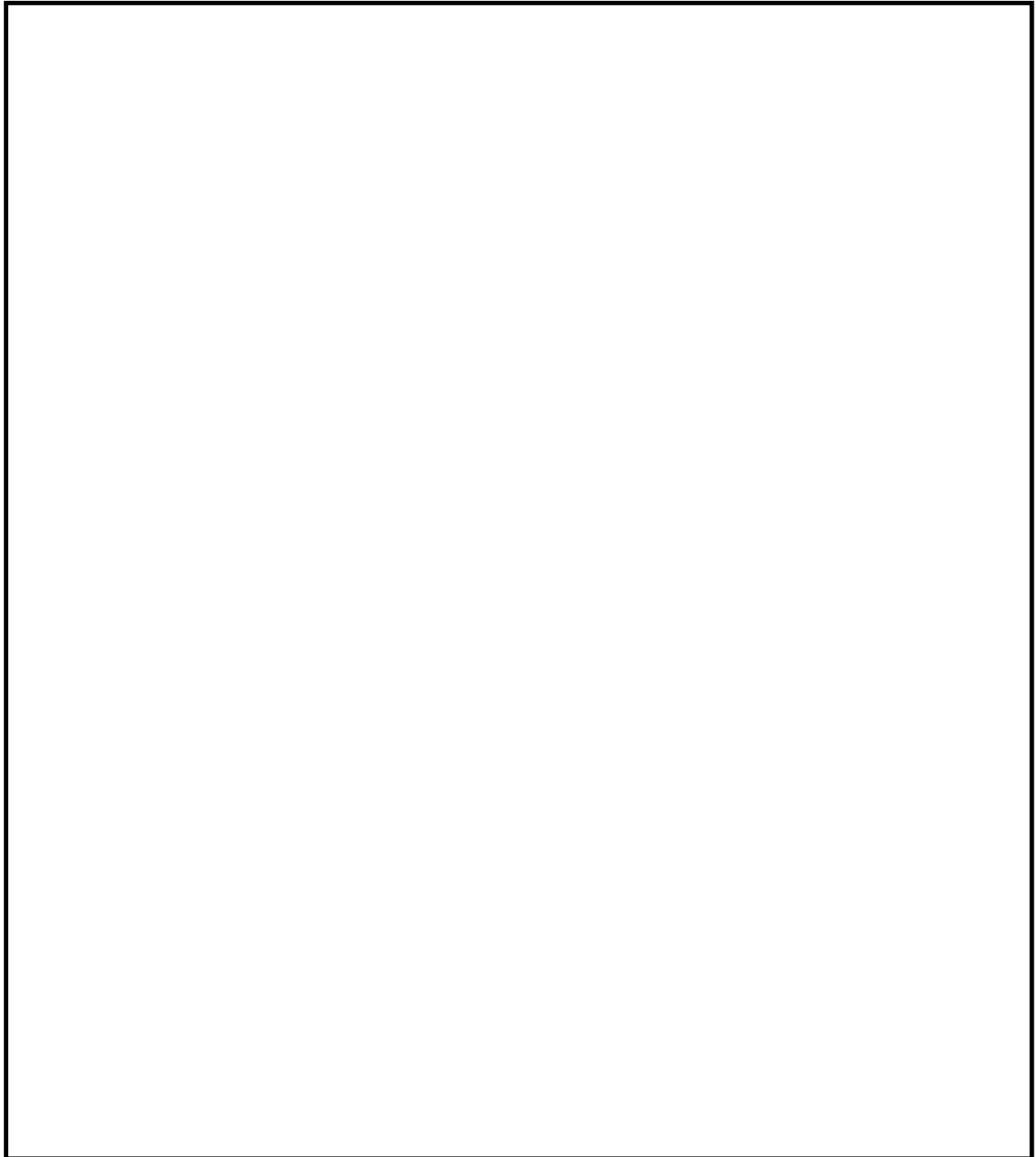


DEVELOPING A QUESTION

RESEARCHING YOUR TOPIC

- *To learn, you will need to find science journal articles, books, and internet resources that relate to your topic. These sources will be listed in a bibliography for your project.*

Keep a good record of all of your sources. This might include printing out hard copies of research or saving research into a folder in electronic format. Make a list of possible websites, magazines articles (online or in print), and other resources you can use for your research.



DEVELOPING A QUESTION

RESEARCH RATIONALE

- *To write your research rationale, you will a) summarize important facts you learned by researching your topic, b) discuss how those facts relate to your project question, and c) explain why your project is important and/or how your project might impact society.*

Write down questions you might have based on your research. Why your research is important?

RESEARCH QUESTION OR GOAL

- *A strong research question (or hypothesis or engineering goal) will a) describe your question or goal, b) explain expected outcomes to the project, and c) discuss how the question is based on your research rationale.*

What, exactly, do you want to know? What goal or an expected outcome for your project?

PROJECT DESIGN—WAYS TO GATHER DATA

You are able to choose the type of data you want to collect for your project. You can collect different types of scientific data: observational, experimental, modeling/simulation, and derived/compiled. This data can be either quantitative or qualitative, based on how you design your project.

Glossary

Qualitative: describes qualities or characteristics through sense, feelings, emotions

Quantitative: things that can be compared or counted on numerical scale

Data Point: individual piece of factual information

Statistics: collecting, analyzing, and presenting information about numeric data

DATA COLLECTION PROCESS

Look at your research question and make a list of all the different ways you could gather data to help you find an answer.

- Where will you complete your research (at home, in school, in a research institution)?
- What type of data could you collect with a survey?
- Would you want numeric data (quantitative) or observational data (qualitative)?
- What sort of materials do you need to complete your research?
- Could your project be tested by using instruments (i.e. ruler, thermometer, scale)?
- Would making a model (physical or computer-based) help you test your question?
- Is there a public database already in existence that could be used to test your question?
- Over what period of time should you collect data (i.e. minutes, days, weeks)?
- How many data points might you need to collect (i.e. number of measurements, number of days, number of surveys) for a strong study?

PROJECT DESIGN—WAYS TO GATHER DATA

A research plan includes the following headers: a) Project Rationale; b) Research Question (or Hypothesis or Engineering Goal); c) Data Collection Process; d) Risk and Safety; e) Data Analysis; and f) Research Bibliography. You should already have written the first three earlier.

RISK AND SAFETY

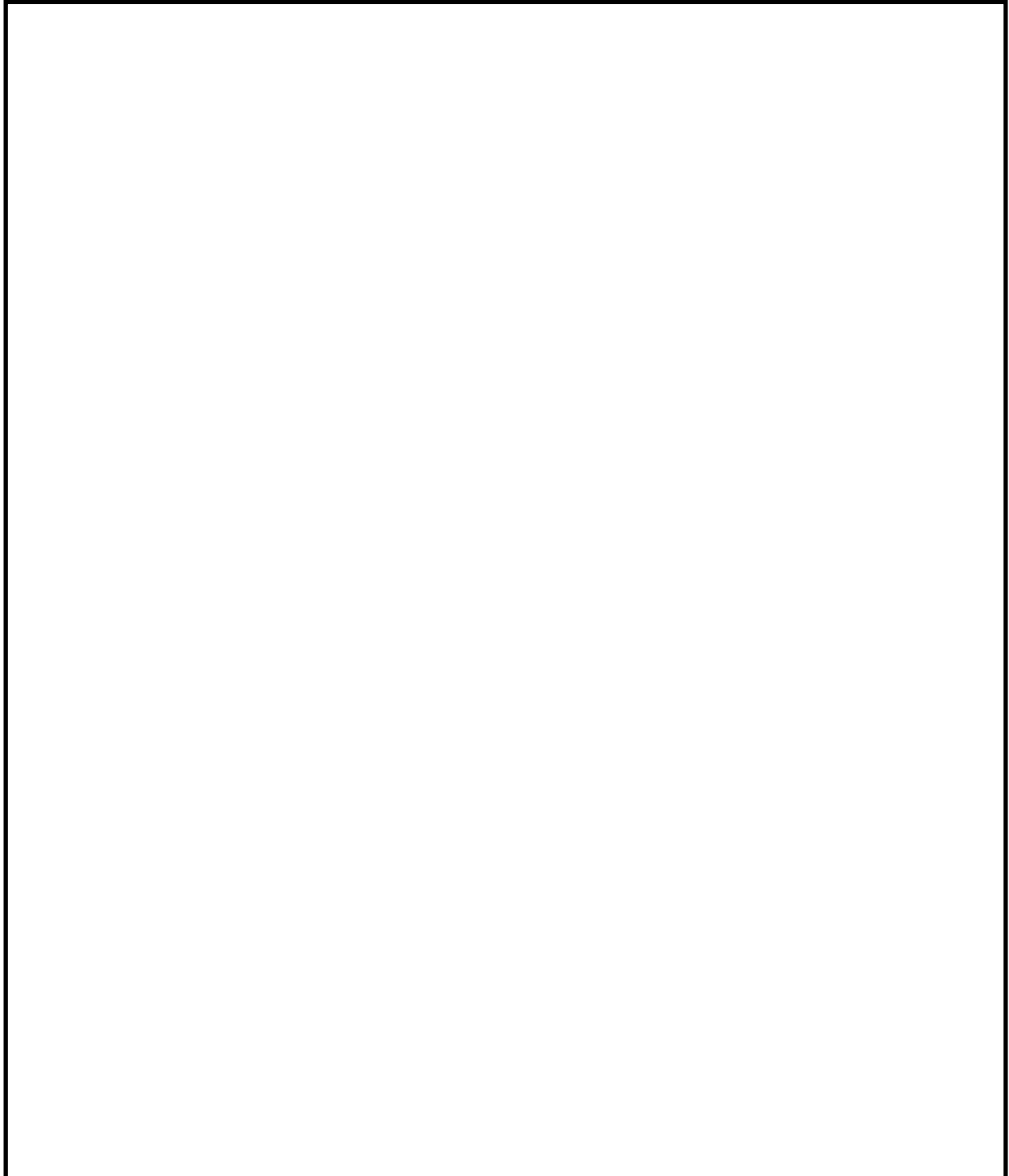
Write down any risks to you or your participants. Write down precautions you can take to make your project safer. If you can't think of any risks, explain why your project does not have safety risks. If your project includes human subjects, vertebrate animals or hazardous materials, your research plan needs to include answers to the questions in the Risk and Safety Handout.

DATA ANALYSIS PLAN

Describe how you plan to analyze the data and results from your project. This might be calculating averages or percentages, comparing and contrasting data, showing frequency of data, and more. How do you think you will analyze your data based on your project design?

RESEARCH BIBLIOGRAPHY

Make a formal list of all of the research you have used (APA format preferred for scientific papers). You might discover that you will need to add a new source or two to this list after your experiment is done. Remember that if you plan to use vertebrate animals, one of these references must be an animal care reference.

A large, empty rectangular box with a black border, intended for the student to write their research bibliography. The box is currently blank.

RISK AND SAFETY HANDOUT

HUMAN SUBJECTS

1. Participants: Describe age range, gender, racial/ethnic composition of participants and indicate how participants will be invited to participate. What will participants be asked to do? Will you use any surveys, questionnaires or tests? What is the frequency and length of time involved for each subject?
2. Risks: What are the risks or potential discomforts (physical, psychological, time involved, social, legal, etc.) to participants? How will you minimize risks? How will you protect the privacy of your participants?
3. Informed Consent Process: Describe how you will inform participants about the purpose of the study, what they will be asked to do, that their participation is voluntary, and they have the right to stop at any time. Attach a copy of an Informed Consent document to the Research Plan.

VERTEBRATE ANIMAL RESEARCH

1. Participants: Detail animal numbers, species, strain, sex, age, source, etc. Describe housing and oversight of daily care.
2. Risks: Detail all procedures to be used, including methods used to minimize potential discomfort, distress, pain and injury to the animals and detailed chemical concentrations and drug dosages. Discuss disposition of the animals at the termination of the study.
3. Alternatives: Discuss potential alternatives to vertebrate animal use and present justification for use of vertebrates. Explain potential impact or contribution of this research.

HAZARDS – MATERIALS, BIOLOGICAL AGENTS, CHEMICALS, DEVICES, ACTIVITIES

1. Hazards: Identify all hazardous materials, biological agents, chemicals, devices, or activities that will be used; identify microorganisms exempt from pre-approval.
2. Risks: Identify and assess the risks involved with the use of hazardous materials, devices, and/or activities in this project. Identify a supervisor for this project and discuss how this supervision will take place.
3. Precautions: Describe the safety precautions and procedures that will be used to reduce the risks. When applicable, describe the disposal procedures that will be used for hazardous materials or biological agents.