Birdwood High School 9AIL - 2016

Science Fiction to Science Fact – Student Booklet

Student Name \_\_\_\_\_\_\_\_\_\_\_\_

Science Teacher \_\_\_\_\_\_\_\_\_\_\_

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**Outcomes**

|  |  |  |
| --- | --- | --- |
| **Content Strand** | **Content Descriptors** | **Aspects of Achievement Standard** |
| Science Understanding | **ACSSU182** Energy transfer through different mediums can be explained using wave and particle models | Students describe models of energy transfer and apply these to explain phenomena. |
| Science as a Human Endeavour | **ACSHE157** Scientific understanding, including models and theories, is contestable and is refined over time through a process of review by the scientific community;  **ACSHE158** Advances in scientific understanding often rely on developments in technology and technological advances are often linked to scientific discoveries;  **ACSHE228** Values and needs of contemporary society can influence the focus of scientific research;  **ACSIS164** Formulate questions or hypotheses that can be investigated scientifically; | Students describe social and technological factors that have influenced scientific developments and predict how future applications of science and technology may affect people’s lives.  Students design questions that can be investigated using a range of inquiry skills. |
| Science Inquiry | **ACSIS174** Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations. | Students evaluate others’ methods and explanations from a scientific perspective and use appropriate language and representations when communicating their findings and ideas to specific audiences. |
| Digital Technologies Processes and Production Skills | **ACTDIP040** Design algorithms represented diagrammatically and in structured English and validate algorithms and programs through tracing and test cases  **ACTDIP044** Plan and manage projects using an iterative and collaborative approach, identifying risks and considering safety and sustainability | Students design modular programs, using algorithms and data structures involving modular functions that reflect the relationships of real-world data and data entities.  Students plan and manage digital projects using an iterative approach. |
| Historical knowledge and understanding | **ACDSEH082** The short and long-term impacts of the Industrial Revolution, including global changes in transport and communication | Students analyse the causes and effects of events and developments and make judgments about their importance. |

**Science Practical-Energy Transfer**

Energy is vital for almost everything including movement and life. There is a universal **law of conservation of energy,** which says that energy can be neither created nor be destroyed; however, it can change from one form to another. Electrical energy powers drones to fly, chemical energy combusts to propel rockets into space and some submarines harness nuclear energy to power them kilometers underwater.

The purpose of this practical is to observe and identify different energy changes.

**Materials**

|  |  |
| --- | --- |
| Alligator clips | Light globe |
| Battery or power pack | Switch |
| Steel wool | Heatproof mat |
| 200g mass | Modeling clay |
| Polystyrene ball | Rubber band |

Put on your safety glasses then complete the following tasks before filling in the table below:

**Part A:** Use 2 alligator clips to connect a light globe to a battery or power pack.

**Part B:** Place strands of steel wool on a bench mat. Use alligator clips (3) to connect these to a battery and a switch. DO NOT leave the switch closed.

**Part C:** Strike a tuning fork on a rubber stopper. Put the ends of the tuning fork into a beaker of water.

**Part D:** Drop the 200g mass onto a lump of modeling clay from a height of about 30cm.

**Part E:** Place a polystyrene ball on the bench. See if you can make the ball roll along the bench using a stretched rubber band.

Record your observations in the table below. Next to your observations list the source of energy in each case, and any forms of energy produced.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Part | Situation | Observations | Energy supplied | Energy produced |
| A | Connecting a light globe to a battery |  |  |  |
| B | Connecting steel wool to a battery |  |  |  |
| C | Striking a tuning fork and dipping its ends into water |  |  |  |
| D | Dropping a 200g mass onto a lump of clay |  |  |  |
| E | Propelling a polystyrene ball using a rubber band |  |  |  |

/15

When you call someone on your smart phone what energy transformation is taking place?

/4

When you accelerate in your car what energy transformation is taking place?

/4

What is usually released as a waste product during energy transformations? ……………… /1

Explain the energy transformations occurring as our bodies move to play sport or do exercise

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/5

Name the type of energy possessed by fossil fuels: ………………………………………… /1

**Energy efficiency** is a measure of how much input energy is converted into useful output energy.

In 10 minutes, a power saw used 6050 /j of electrical energy. It converted:

1210 J into kinetic energy

1520 J into sound energy

3320 J into heat energy

What is the useful output energy from the saw? …………………………………………….. /2

Calculate the percentage energy efficiency of the saw:

……………………………………………………………….……………………………………. /3

If a petrol car engine has a 25% efficiency what percentage of the energy is wasted?……. /1

An iPod dock is supplied with 2000 J of electrical energy. Of this, 900J is converted into heat energy, 300 J is converted into kinetic energy of the sound system and the remainder is converted into sound.

Calculate the:

Number of joules of sound energy produced …………………………………………………. /1

Percentage efficiency of the device for converting electrical energy into sound energy

……………………………………………………………………………………………………… /3

/40

**Science Practical-Electrical Circuits**

Electricity is one of many forms of energy. **Electrical energy** powers your MP4 player, laptop computer, hairdryer, iPhone and electric toothbrush. It starts the car and lights up the streets and your home at night. What makes electrical energy so useful is that it is easily transformed into other forms of energy such as heat, light and sound. **Current electricity** is the form of electricity that you use every day and is the form that you get from batteries and power points. To use current electricity, you need an electric circuit.

Remember how everything is made of atoms, which are themselves made of protons, neutrons and electrons? If an atom has more protons than electrons it is positively charged. If an atom has more electrons than protons it is negatively charged. These **charged atoms** are known as **ions**.

In current electricity electrons move along a wire. This movement of electrons is known as an **electric current**. Electrons need a path to travel around. This path is called an **electric circuit**. Any break in an electric circuit stops the flow of electrons and stops them delivering their energy.

**Part 1**

**Materials**

|  |  |
| --- | --- |
| Lemons and/or other fruits/veg | Copper nail or stripped copper wire |
| Iron nail | Milliammeter/multimeter |
| LED | Connecting wires |
| Paper towel |  |

1. Soften the inside of the lemon a little by squeezing it (don’t break it).

2. Insert the copper wire/nail/sheet into the lemon.

3. Do the same with the iron nail/sheet.

4. Connect the copper electrode to either the positive terminal of the milliammeter/multimeter or the long terminal of the LED.

5. Connect the iron electrode to the negative terminal of the milliameter or short terminal of the LED. A current should flow immediately. Record the current flowing or describe how brightly the LED shines.

6. Remove the electrodes and pat dry with paper toweling. Repeat the experiment with different fruit and vegetables.

7. Increase the energy supplied by connecting up a series of the same types of fruit. Start with two, then three and so on.

|  |  |  |  |
| --- | --- | --- | --- |
| Type of fruit/veg | Number of fruit/veg | Current (mA) | Brightness of LED |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

/10

Identify the electrolyte (conducting liquid) in these batteries: …………………….………….. /1

Why did you soften the inside of the lemon before starting the experiment?

………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………… /2

In a **series circuit**, all the components of the circuit are connected up one after another to form a single loop. Series circuits are the easiest of all circuits to connect up but are not very practical.

A **parallel circuit** has a number of branches, each branch having its own components. The electrical wiring in a house is one large parallel circuit.

**Part 2**

**Materials**

|  |  |
| --- | --- |
| Three globes | Power pack |
| Connecting wires | Switch |
| Ammeter | Voltmeter |

1. Connect up a basic circuit containing a wires, a battery, a switch, a light, an ammeter and a voltmeter.

2. Measure the current flowing through the globe and the voltage lost across it. Also note the brightness.

3. Add another globe to construct a series circuit.

4. Measure the current and voltage and record the brightness of the globes.

5. Remove the second globe and re-connect it so that it is in parallel.

6. Once again, measure the current and voltage and record the brightness of the globes.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Single globe | Globes in series | Globes in parallel |
| Brightness |  |  |  |
| Current (A) |  |  |  |
| Voltage (V) |  |  |  |

/9

Explain your results:

………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………

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Why would it be necessary for your car to have parallel circuits for its lights, indicators, wipers and airconditioner?

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/4

/30

**Science Practical-Motors and Generators**

Around a magnet is an invisible force field called a **magnetic field** which exerts forces on materials containing large amounts of iron (or cobalt or nickel) and other nearby magnets.

A magnetic field is also produced when electric currents flows along a wire, this is known as **electromagnetism**. By coiling the current-carrying wire, the magnetic field can be made stronger. The magnetic field can be controlled by the current flowing through it. Electromagnets can be used to make **electric motors**. These motors require electricity to work. Other methods can actually generate electricity using natural processes.

**Materials:**

|  |  |
| --- | --- |
| Solid copper wire | Sandpaper |
| 2 large paperclips | 2 insulating connecting wires |
| Pliers | Bar magnet |
| Plastic or paper cup | Sticky tape |
| 1.5V AA battery | Rubber band |

1. Straighten one end of both paperclips and tape them to the top of the plastic/paper cup.
2. Lightly sand the ends of the copper wire. Wind the copper wire around your finger to make a coil, leave 2 straight sections about 1cm long on each side, place your coil in the holder formed by the paperclips.
3. Strip about 1cm of insulating plastic off the ends of both connecting wires.
4. Use the rubber band to secure these stripped ends to each end of the battery.
5. Attach the other ends of the wires to the paperclips.
6. Hold the bar magnet close to the coil. If your motor doesn’t spin try giving the coil a flick or remove the coil and reshape so the straight parts are exactly central.

**Discussion:**

1. A motor changes the form of energy. State what type of energy is:
   1. Provided to the motor …………………………………………………………….. /1
   2. Produced by the motor ………………………………………………………… /1
2. Why won’t the motor spin without a magnet nearby?

……………………………………………………………………………………………………………………………………………………………………………………………………………… /2

1. Identify 3 ways we use motors to make life easier:
   1. ………………………………………………………………………………………. /1
   2. ………………………………………………………………………………………. /1
   3. ………………………………………………………………………………………. /1
2. Identify 2 ways an electric motor could be more efficient than a petrol motor:
   1. ……………………………………………………………………………………….. /1
   2. ……………………………………………………………………………………….. /1
3. Coal is Australia’s main source of electrical energy. What are 2 disadvantages of coal?
   1. …………………………………………………………………………………….. /1
   2. …………………………………………………………………………………….. /1
4. Identify 2 forms of renewable energy that could be easily harnessed in South Australia:
   1. ……………………………………………………………………………………….. /1
   2. ……………………………………………………………………………………….. /1

Nuclear power plants create electricity as they obtain the heat needed to produce steam through a physical process called fission, which entails the splitting of atoms of uranium in a nuclear reactor. This produces nuclear waste which is hazardous to most forms of life and can take millions of years to decay.

31% of the world’s uranium is found in Australia. The Australian government currently exports uranium to be used in nuclear power in other countries, producing nuclear waste.

The submarines to be built in South Australia may include nuclear powered submarines which will produce nuclear waste.

The South Australian government is currently considering creating a nuclear waste dump in our state. Some sources are estimating that this could generate $445 billion for the state’s economy.

1. Discuss the benefits of a nuclear waste dump in South Australia.

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1. Discuss the negatives of having a nuclear waste dump in South Australia.

…………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………… /4

1. Make a judgment on whether you think South Australia should have a nuclear waste dump. Give reasons for your opinion.

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**Jobs in STEM**

Many governments have ealized that building up Science Technology Engineering and Mathematics (STEM) areas of their industries can have a positive influence on the future of a country.

“STEM is critical to boosting Australia’s international competitiveness and national well-being. STEM knowledge and skills lead to new products, more efficient services, and a more diverse, resilient and sustainable economy. As a nation, a better understanding of science and maths will help us address national challenges and ensure that Australians can continue to enjoy good jobs, quality health care, a sustainable environment and the opportunities and services they deserve.” Commonwealth of Australia, 2016, *STEM Vision for a Science Nation*, <http://science.gov.au/scienceGov/Pages/STEMVisionforaScienceNation.aspx>

What sort of jobs do people who have an interest in STEM do? Using either 1. A Scientist, Technologist, Engineer of Mathematician you know and/or 2. The My Future Webpage <https://myfuture.edu.au/> or other job website find the following information for a STEM job.

1. Job Title \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Science Technology Engineering Maths (Circle most relevant)
3. What study is required before starting job \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Salary (to nearest $10000) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Where in Australia does this job exist? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. What sort of tasks does the job include (at least 5 tasks)? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. How many people do this type of job in Australia? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

/10

**Energy and Machines**

Energy is vital to us all. Something that has energy can do work. Energy is measured in a unit called a joule. This is a small unit and we often use kilojoules ( 1 KJ = 1000J ) or megajoules ( 1 MJ = 1000 000 J )

***Electricity is measured in kilowatt hours and gas is measured in megajoules***

***Task 1***: Research energy conversions on the internet and complete the following conversion table.

***CONVERSION TABLE:***

|  |  |
| --- | --- |
| 1 Kilowatt (k) = | Watts (w) |
| 1 Kilowatt hour (kWh) = | Watt hours(Wh) |
| 1 Megawatt hour (MWh) = | Kilowatt hours (kWh) |
| 1 kilowatt hour (kWh) = | Megajoules (MJ) |
| 1 gigajoules (GJ) = | Joules (J) |

/5

***Task 2***: Answer the following questions:

1. If a light globe runs for 24 hours a day, 365 days a year, how many hours will it run?

24 hours/day x 365 days/year = ----------------------- hours/year.

1. A common light globe uses 60 watts per hour. How many watt hours of electricity will the light globe use in one year?

------------------ hours/year ( from Q.1 ) x 60 = --------------------Wh/year.

1. Now convert watt hours to kilowatt hours.

-------------------------- Wh/year ( from Q. 2) divided by 1000 = ---------------------kWh/year.

/4

***Task 3:*** List ***two examples*** of each type of simple machine.

# 

|  |
| --- |
| **Inclined Plane** |
| **Wedge** |
| **Screw** |
| **Lever** |
| **Pulley** |
| **Wheel and Axle** |



/6

# 

**Robotics Comprehension**

|  |  |  |  |
| --- | --- | --- | --- |
| |  | | --- | | **Read the passage below and answer the questions that follow.** | | Thomasnet.com, 2016, *Robotics History*, http://www.thomasnet.com/articles/engineering-consulting/robotics-history | | **Robotics**  Although the science of robotics only came about in the 20th century, the history of human-invented automation has a much lengthier past. In fact, the ancient Greek engineer Hero of Alexandria, produced two texts, Pneumatica and Automata, that testify to the existence of hundreds of different kinds of “wonder” machines capable of automated movement. Of course, robotics in the 20th and 21st centuries has advanced radically to include machines capable of assembling other machines and even robots that can be mistaken for human beings.  The word robotics was inadvertently coined by science fiction author Isaac Asimov in his 1941 story “Liar!” Science fiction authors throughout history have been interested in man’s capability of producing self-motivating machines and lifeforms, from the ancient Greek myth of Pygmalion to Mary Shelley’s Dr. Frankenstein and Arthur C. Clarke’s HAL 9000. Essentially, a robot is a re-programmable machine that is capable of movement in the completion of a task. Robots use special coding that differentiates them from other machines and machine tools, such as CNC (computer numerical control). Robots have found uses in a wide variety of industries due to their robust resistance capabilities and precision function.  **Historical Robotics**  Many sources attest to the popularity of automatons in ancient and Medieval times. Ancient Greeks and Romans developed simple automatons for use as tools, toys, and as part of religious ceremonies. Predating modern robots in industry, the Greek God Hephaestus was supposed to have built automatons to work for him in a workshop. Unfortunately, none of the early automatons are extant.  In the Middle Ages, in both Europe and the Middle East, automatons were popular as part of clocks and religious worship. The Arab polymath Al-Jazari (1136-1206) left texts describing and illustrating his various mechanical devices, including a large elephant clock that moved and sounded at the hour, a musical robot band and a waitress automaton that served drinks. In Europe, there is an automaton monk extant that kisses the cross in its hands. Many other automata were created that showed moving animals and humanoid figures that operated on simple cam systems, but in the 18th century, automata were understood well enough and technology advanced to the point where much more complex pieces could be made. French engineer Jacques de Vaucanson is credited with creating the first successful biomechanical automaton, a human figure that plays a flute. Automata were so popular that they travelled Europe entertaining heads of state such as Frederick the Great and Napoleon Bonaparte.  **Victorian Robots**  The Industrial Revolution and the increased focus on mathematics, engineering and science in England in the Victorian age added to the momentum towards actual robotics. Charles Babbage (1791-1871) worked to develop the foundations of computer science in the early-to-mid nineteenth century, his most successful projects being the difference engine and the analytical engine. Although never completed due to lack of funds, these two machines laid out the basics for mechanical calculations. Others such as Ada Lovelace recognized the future possibility of computers creating images or playing music.  Automata continued to provide entertainment during the 19th century, but coterminous with this period was the development of steam-powered machines and engines that helped to make manufacturing much more efficient and quick. Factories began to employ machines to either increase work loads or precision in the production of many products.  **The Twentieth Century to Today**  In 1920, Karel Capek published his play R.U.R. (Rossum’s Universal Robots), which introduced the word “robot.” It was taken from an old Slavic word that meant something akin to “monotonous or forced labor.” However, it was thirty years before the first industrial robot went to work. In the 1950s, George Devol designed the Unimate, a robotic arm device that transported die castings in a General Motors plant in New Jersey, which started work in 1961. Unimation, the company Devol founded with robotic entrepreneur Joseph Engelberger, was the first robot manufacturing company. The robot was originally seen as a curiosity, to the extent that it even appeared on The Tonight Show in 1966. Soon, robotics began to develop into another tool in the industrial manufacturing arsenal.  Robotics became a burgeoning science and more money was invested. Robots spread to Japan, South Korea and many parts of Europe over the last half century, to the extent that projections for the 2011 population of industrial robots are around 1.2 million. Additionally, robots have found a place in other spheres, as toys and entertainment, military weapons, search and rescue assistants, and many other jobs. Essentially, as programming and technology improve, robots find their way into many jobs that in the past have been too dangerous, dull or impossible for humans to achieve. Indeed, robots are being launched into space to complete the next stages of extraterrestrial and extrasolar research. | |

1. Who wrote the first books about human invented automation?
2. Why would a desktop computer not be considered a robot?
3. Which of these machines were **NOT** built by Arab polymath Al-Jazari?
   1. A waitress that served drinks
   2. A monk that kissed a cross
   3. A robot band
   4. An elephant clock that sounded the hour
4. Why was Charles Babbage’s machine never finished?
5. Which scientist suggested that differential machines could be used to play music?
6. What are two reasons that factories employed machines during the industrial revolution?
7. Which language was the word robot derived from?
8. How long did it take for Capek’s robots to go from Science Fiction to Science Fact?
9. Where did the first Industrial Robot work?
   1. France
   2. Japan
   3. United States of America
   4. Australia
10. Why might George Devol be considered the father of modern robotics?
11. Which TV Show featured a robot in 1966?
    1. The Tonight Show
    2. Asimov’s Mysteries
    3. Beyond 2000
    4. Today Tonight
12. What needs to improve for robots to further improve?
13. Choose seven of the underlined words and write seven new sentences containing these words.

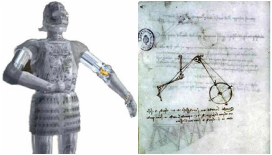
/20

**Aeronautics Timeline**

*Da Vinci: Humanoid Robot*



*First Flight*



*Roomba*

1. In what ways are the following connected? Ensure you discuss how each is connected to the common theme.

* Leonardo Da Vinci
* The Montgolfier Brothers
* English King Bladud

........................................................................................................................................................

......................................................................................................................................................

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1. In what ways are the following connected? Ensure you discuss how each is connected to the common theme.

* Aristotle
* Isaac Asimov
* Leonardo Da Vinci
* Roomba

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1. Task:

In this activity you will ***compare*** the timelines of 2 Major Inventions that have changed our lives and will continue to change our lives in the future in ways we cannot imagine.

***Compare*** the timelines of Flight and Robotics. The following will guide your work.

* 1. Ensure that your timelines are scaled so you can ***compare*** each timeline accurately. *E.g. 1700 should be in the same place on each line!*
  2. You may use an ***online template***, or simply ***draw*** your timeline on paper.
  3. The timelines both need to include at least ***10 important points*** (what you think is important) in the history of each technology. (5 marks for each timeline)
  4. Both timelines should ***begin*** ***BC*** and ***end in the future***. (4 marks for readability and creativity)

(14 Marks)

Total (20 marks)

# 

**Drones**

**Drone** technology has been around for a long time. Initially drones were developed and used for military purposes with the first pilotless aircraft built during and shortly after World War I. Drones have come a long way since then. They have gone from being the province of the military to having a variety of commercial application and as a toy for children. There use continues to be on of great debate in terms of privacy, safety and security, among other issues.

In this activity you will be investigating a current, existing use of a drone.

Before beginning, please watch the following videos for further insight, ideas and inspiration:

Drone fishing: <http://www.abc.net.au/news/2016-05-03/drone-fishing-video-featuring-school-of-hungry-tuna-goes-viral/7378870>

Australia Done-Post: <http://www.smh.com.au/technology/innovation/australia-post-tests-drones-for-parcel-delivery-20160415-go77a4.html>

Amazing drone footage: <http://www.digitaltrends.com/photography/new-yore-city-drone-film-festival-2016-montage/>

Domino-Drone: <http://www.theaustralian.com.au/business/technology/dominos-pizza-unveils-robot-delivery-boy/news-story/04d9f15f076ab624454190489b4dda45>

Research your chosen device (drone) and answer the following questions.

1. What is the purpose of your device and what problem does it solve?

………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………… /3

2. Describe how the device makes a contribution to one or more of the following? /2

a. environmental problems

………………………………………………………………………………………………………………………………………………………………………………………………………………………………

b. personal needs of people

………………………………………………………………………………………………………………………………………………………………………………………………………………………………

c. community issues

………………………………………………………………………………………………………………………………………………………………………………………………………………………………

3. Provide details on how the device is powered.

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4. Describe how the operator and device communicate with each other.

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5. How is the device controlled and/or programmed?

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6. Who uses your chosen device?

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7. Describe any issues that might be associated with the use of the device. Some possible issues you could discuss are safety, privacy, environmental damage, laws and legislation.

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8. Evaluate your device by comparing and weighing up its benefits and limitations.

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9. Propose possible modifications or improvements that would enable your chosen device be applied more widely and to a greater variety of circumstances?

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**Simple Machines**

There are 6 types of ***simple machines***. These are usually combined to form compound machines that perform very complex jobs.

***Work*** is defined as the force that is applied x the distance an object moves 

Formula: Work = Force x Distance or 𝑤=𝑓×𝑑

Using a simple machine, means that less force needs to be applied. To achieve this, the distance required to move the effort is much greater.

1. How are simple machines different from compound machines?

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2. How do simple machines make it easier to do work?

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Wedge

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3. How are simple machines used in everyday life? Give 2 examples to illustrate your answer.

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4. Use the formula above to calculate the work done if 320 joules of force is applied and the distance the effort is applied for is 2m.

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5. What is the scientific definition of a force?

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**Alternate Energy**

A secure supply of adequate, affordable and reliable energy is vital for Australia’s economic growth and success. Our energy resources are used to power our homes, cars and business’. Until recently, Australia’s energy needs have been met largely by sources such as coal, oil and gas. As a result of concerns regarding sustainability, energy sources such as solar and wind have undergone substantial growth in Australia.

Use [www.arena.gov.au](http://www.arena.gov.au) to answer the following questions.

Why is alternative energy also known as renewable energy? /2

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Discuss **three** separate issues of non-renewable energy. /3

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List six examples of renewable energy, and a short description (in your own words) of each: /6

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More than 2 million Australian households have (PV) systems on their roof. What is a (PV) system and what does it do? /2

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Use <https://www.originenergy.com.au/blog/about-energy/energy-in-australia.html> to answer the following questions:

Describe bioenergy, using the terms *biomass, renewable, greenhouse emissions* and *energy security.* /2

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Complete the following sentences: /1

\_\_\_% of fuels in Australia are generated from fossil fuels. \_\_\_% of this is generated from coal and \_\_\_% from natural gas. Renewable energy sources make up \_\_\_% of Australia’s energy supply.

List **three** reasons why non-renewable energy sources have not been entirely replaced in Australia with renewable energy sources: /3

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Why is wind and solar power known as intermittent energy sources? What do they rely on? /1

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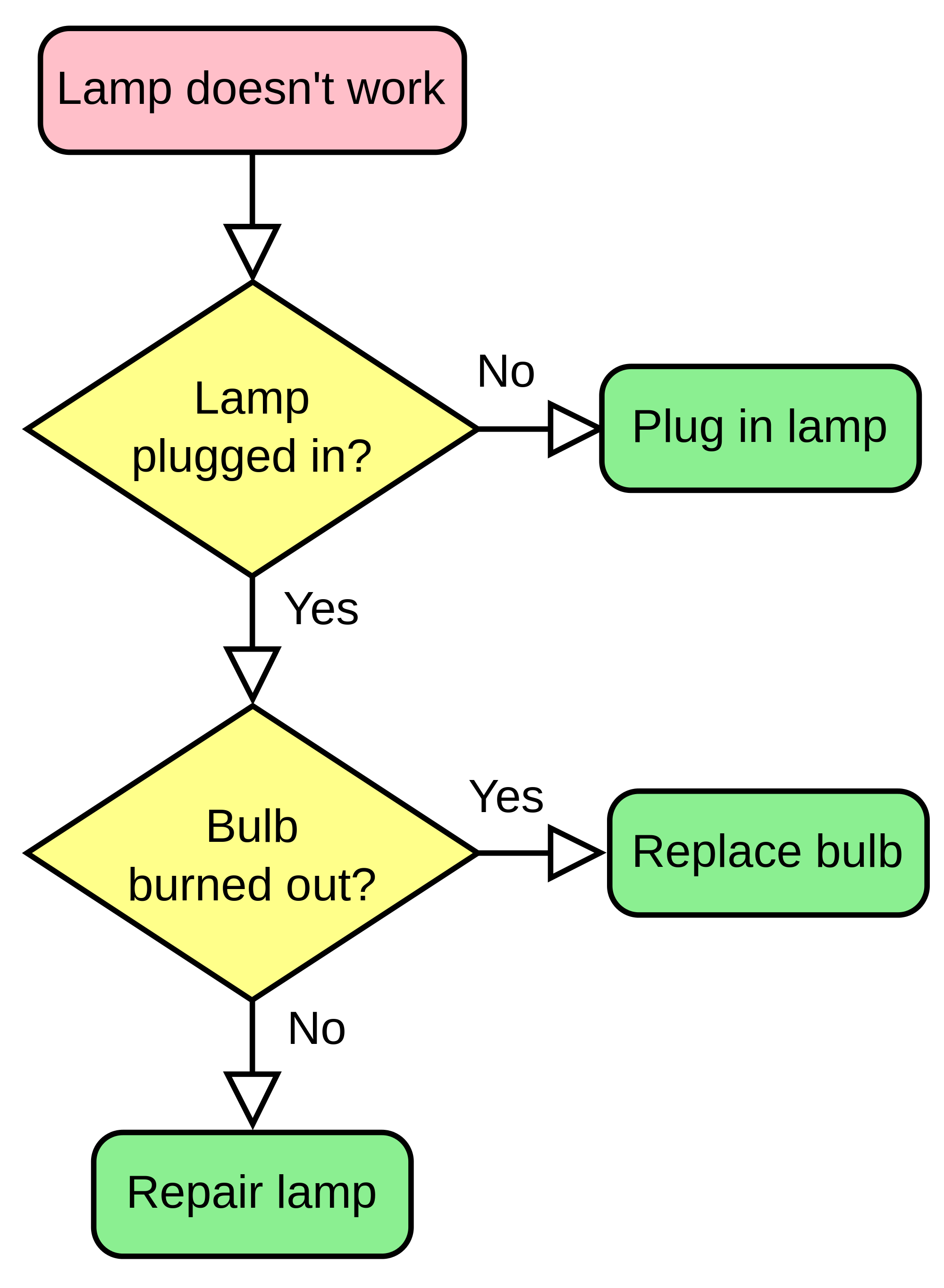
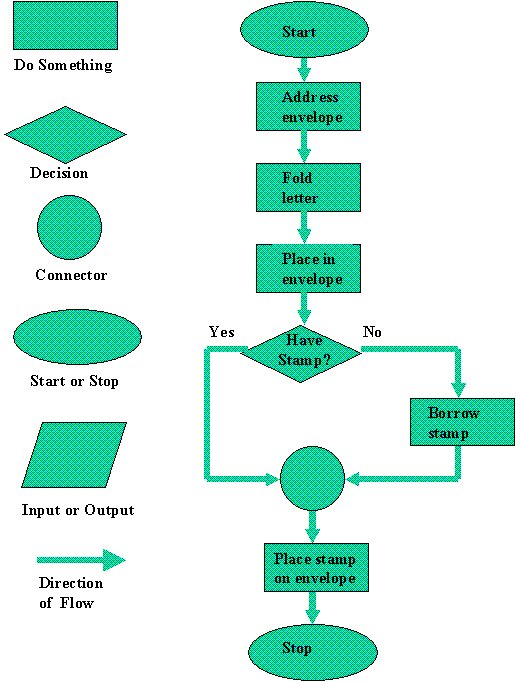
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**Programming and Digital Systems**

Computer systems, including robots use a set of instructions known as an ***algorithm*** to tell them what to do. Algorithms contain inputs, outputs and a series of steps to get from one to the other. These algorithms can be represented in either diagrams or structured English. The effectiveness of an algorithm is determined by how simply you can get from the inputs to the outputs.

**Programing Diagrams**

Programming diagrams are a type of flow chart that visually represent the binary (2 options only) choices that are taken by a system

**Structured English**

Structured English, sometimes referred to as pseudocode is a process by which elements, also known as constructs, are presented in a logical order. These constructs are able to be embedded to give sub instructions. The main constructs are

**SEQUENCE** is a linear progression where one task or choice is performed sequentially after another.

**WHILE** is a loop (repetition) with a simple conditional test at its beginning.

**IF-THEN-ELSE** is a decision (selection) in which a choice is made between two alternative courses of action.

**REPEAT-UNTIL** is a loop with a simple conditional test at the bottom.

**FOR**is a "counting" loop.

**END** the finish of an instruction or set of instructions.

Some examples

|  |  |
| --- | --- |
| WHILE it is raining  Put up umbrella  ENDWHILE | IF it is 25th December THEN  It is Christmas Day  ELSE  It is not Christmas Day  END IF |
| WHILE Christmas Tree is up  IF it is Christmas Day THEN  Open presents  ELSE  Leave presents unopened  ENDIF  ENDWHILE | WHILE It is morning AND I have not had breakfast  IF I am hungry THEN  Have breakfast  ELSE  Don’t have breakfast  ENDIF  ENDWHILE |

**Task** Create both a Programing Diagram and a Structured English list to describe your decision process when getting up in the morning getting up in the morning

/10

**Transport Past Present Future**

During the industrial revolution, new technologies and inventions transformed the way people lived and worked. Major changes in farming, mining, agriculture, manufacturing and transport changed almost all aspects of life. Britain’s population alone quadrupled from 6.5 million in 1750 to around 32.5 million in 1900.

At the start of the industrial revolution, transport in Britain was slow and costly, regardless of whether people travelled by road, river or sea. As a result of a demand for quicker and cheaper forms of transport to move products to market and to speed travel between cities, a number of new inventions and improvements were made to transport.

One new invention during the industrial revolution was the steam locomotive. What is a steam locomotive? /2

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What was the name of the English engineer who invented it? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Name three roles transport played in the industrial revolution. /3

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In the early 1700’s, most roads in Britain were built and maintained by local inhabitants – much different to the councils and government organisations maintaining roads today.

Who were the turnpike trusts? /2

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What impact did they have on roads and transport? /2

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Railways added a whole new phase to the industrial revolution. The first railway line was built between the coalfields in Darlington in\_\_\_\_\_. By 1848, over 40 million train journeys were made in Britain.

Name three benefits of the development of the railway line: /3

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Before the industrial revolution, the journey from London to Edinburgh took 12 days by horse-drawn coach. By 1836, it took under two days by train, and less than 12 hours by 1850 when all of Britain was linked by rail. Use <https://www.virgintrains.co.uk/> to complete the following table:

|  |  |  |  |
| --- | --- | --- | --- |
| **Journey:** | **1836** (hours): | **1850** (hours): | **2016** (hours): |
| London – Edinburgh | 49 hours | 12.5 hours |  |
| London – Liverpool | 24 hours | 6.6 hours |  |
| London – Brighton | 6 hours | 1.25 hours |  |
| London – Birmingham | 11 hours | 3 hours |  |

/4

The industrial revolution saw new modes of transport invented to replace horse drawn carriages such as the first car, the *Benz Patent-Motorwagen* by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. As a result, a number of new inventions and improvements were made that led the way cars to be available for many, not just the wealthy. Use <https://www.britannica.com/biography/Henry-Ford> to answer the following questions.

Who was Henry Ford, and what is he remembered for? /2

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Describe how Henry Ford’s method revolutionised transport. /2

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**Engineering Design Process**

The engineering design process is a series of steps that engineers follow to come up with a solution to a problem. Many times the solution involves designing a product that meets certain criteria and/or accomplishes a certain task.

Identify the Problem

Explore/Research

Design/Brainstorm

C

Create

Test

Improve

*Engineers rarely follow the process exactly; often they move back and forward through the steps as the refine their design.*

**Major Task:**

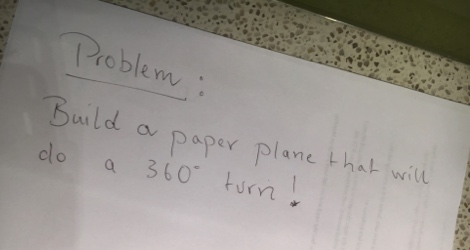
You will apply the ***Engineering Design Process*** to your own design in your chosen area of:

* Drones
* Rockets
* Robots
* Machines
* Alternative Energy

***For each step in the process,***

1. Provide photographic evidence: At least 8 photos
2. Provide a discussion of the following:
   1. Explain what is happening in the photo/s
   2. State the engineering process represented
   3. Reflect on the science and or what you have learned from the process

**What was my Problem?**

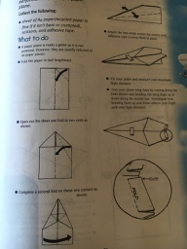


**Research/Explore**



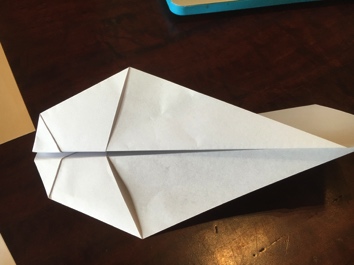
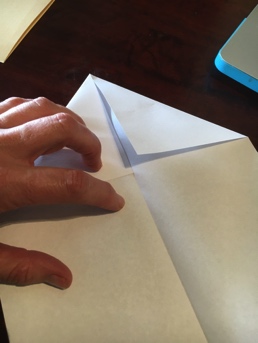
*These are some models that I have researched and a website I visited to research elements for my design. The wings and the front of the both models will create some drag to create circular flight.*

**Design/Brainstorm/Create**



*The problem that I would like to solve is to design a plane that will be a stunt plane. The science in this is around aerodynamics. The design will need to hinder the airflow at the back or front of the plane to create drag.*

http://www.wikihow.com/Make-a-Trick-Paper-Airplane



**Test**

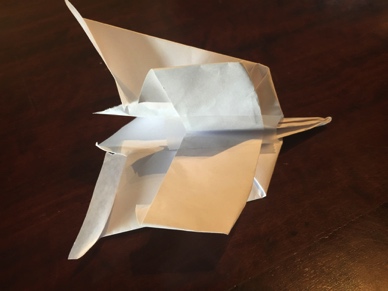
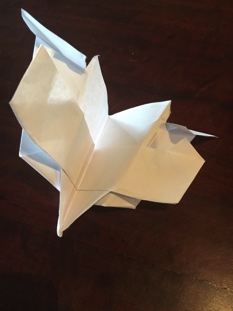
**Major Photo Task: Photo Story including the Engineering Process**

**Christine Cameron 9.1**

*This was a trial using several features from the research on stunt planes.*

*Here you can (sort of) see where the plane does a 360degree flip. It is fast and not as big as I am looking for.*

**Improve/Test/Improve/Test/Improve/Test**



***New Designs****: In the above photos, each represents a new design, a test, then an improvement. Each was a failure. The first design represents a mix of the above research and then a design that I felt created drag in the right place. NO!*

***Details:*** *I added some ailerons (as on an aeroplane) to increase the drag. NO!*

*The design was also stuck together to create a stable design in the air. The drag was improved in the final design and this increased the stunt ability but not the loop size.*

***I would not say that I have failed, but that I have learned what doesn’t work!***

***What have I learned?***

*The design was too heavy and the ailerons in the down position did not create drag enough to turn the plane. In a upward position works better. Next test will be to reduce the weight therefore the lift will improve.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **10** | **8** | **6** | **4** | **2** |
| **Photos** | | | | |
| More than 8 photos clearly show what is happening | 8 photos show what is happening, | Less than 8 photos mostly show what is happening | Very few photos which are difficult to see | Very few poorly taken photos  No evidence = no score |
| **Explanation of what is happening** | | | | |
| Explanation is clear and simple to understand | Explanation is generally simple to understand | Explanation is not very clear and may be difficult to understand | Explanation is too brief and unclear | Poor attempt to explain what is happening  No evidence = no score |
| **Engineering Process** | | | | |
| Engineering process has been used and clearly linked to the photos | Engineering process has been referred to in relation to some photos | Student has made an attempt to apply the Engineering process | Student has made a poor attempt to apply the Engineering process | Little evidence of the Engineering Process  No evidence = no score |
| **Reflection** | | | | |
| Reflection of what has been learned/science represented is clear and logical | Reflection of what has been learned/science represented is mostly clear and logical | Reflection of what has been learned/science represented is not clear and too brief | Reflection of what has been learned /science represented is poor and missing in parts | Reflection of what has been learned and or science represented is very poor or absent  No evidence = no score |

**Major Photo Task Rubric**

This can take up more than one page.

(40 marks)