STEM
Freeze Proof Water Bowls



Unit Overview

Freeze Proof Water Bowls is a STEM unit that has been designed to address a real-world problem using the context of responsible animal guardianship (ownership). A problem that is faced by animal guardians (owners) who live in colder areas is animals' water sources freezing over in the winter months. To begin the unit, students will develop their understanding of the responsibilities people have with regard to animal guardianship (ownership) and the Five Domains. Students will then work collaboratively, using technological practices and knowledge to design a potential solution to this problem. As they work through this unit towards a potential solution, they will engage with scientific concepts related to heat transfer and the physical properties of different materials. They will also engage with mathematics as they work with measuring and comparing temperatures and graphing their results.

Unit Timeframe:

The suggested learning experiences in this unit plan are designed to be a starting point and framework for your inquiry unit. Given the open-ended nature of a project which has multiple potential outcomes, you may find your students have other needs which need to be addressed throughout the process to support them to achieve a successful outcome. This is not intended to be a comprehensive unit to be followed prescriptively, as students may go in a variety of directions with this project.

Animal Welfare Achievement Objectives:

> Gain knowledge and develop an understanding of the Five Domains.

> Identify and describe the basic needs of a specific animal species.

> Explain the responsibilities that animal guardians (owners) have with regard to caring for their animals.

STEM Freeze Proof Water Bowls Learning Experiences

Below is a brief outline of each of the learning experiences covered in this unit plan. To see the full details of any of the learning experiences, click on the orange headings.

Learning Experience 1: The Five Domains

Students will be introduced to animal sentience and Five Domains Model of animal welfare through class and small group discussions. To then further their understanding of how animals have their own specific needs in relation to the Five Domains Model, students will complete an activity whereby they are assigned an animal and a domain to research. This will be shared using a Jigsaw strategy so that all others in the class get the same information.

Learning Experience 2: Nutrition

A Skills Flow activity will be completed to support students' understanding of why food and water is vital to an animal's health and wellbeing. Students will also be researching the different amounts of water that different animal species need.

Learning Experience 3: The Problem and Design Brief

Students will be introduced to the design process and the problem that you are going to be addressing as you work through the design process. The design brief will be co-constructed.

Learning Experience 4: Investigation

4A: What's the Problem?

Students will be grouped and then begin to research the problem they are addressing and current solutions that others have to try and combat the problem. If possible, this will also include discussion with stakeholders.

The following two learning experiences are designed to be used flexibly by teachers. Determine your students' level of prior knowledge of these concepts to decide whether these need to be used in full and/or whether further instruction needs to be provided beyond these.

4B: Temperature and Graphs

To ensure students understand the necessary mathematical concepts required to support the creation and evaluation of their technological outcomes, they will practise measuring, recording and comparing temperatures and practise drawing and interpreting line graphs.

4C: Insulator or Conductor?

Students will learn about heat energy, what materials are thermal insulators and thermal conductors and carry out an experiment to determine which material will keep a cup of water warmest for the longest period of time.

Learning Experience 5: Developing Solutions

Students will work in their groups to brainstorm a range of ideas for potential solutions for their technological outcome.

Learning Experience 6: Choosing a Solution

With reference to the design brief, students will refine their ideas and choose the solution they want to pursue.

Learning Experience 7: Models and Prototypes

Students will engage in the process of designing a prototype.

Learning Experience 8: Testing and Evaluation

Students will evaluate their prototypes by testing the temperature of the water in their bowl and in a control bowl and how it changes over time in the cold. They will graph these results and compare.

New Zealand Curriculum Links

Key Competencies

Thinking

- Students will be required to think critically and creatively to develop a solution to the problem they have been posed with.
- Students will be required to ask questions that will help lead them towards a solution.
- Throughout the development process they will be required to evaluate and reflect on the process to inform their next steps.

Using language, symbols and texts

- Students will extend their topic specific vocabulary in relation to science, mathematics and technology.
- As students carry out research to support the design process they will be engaging with a variety of texts and new language.

Managing self

- This unit encourages students' independence and ability to take ownership of their learning. With appropriate scaffolding, students are required to think of a solution to a problem, put into a place a plan that will help them to realise this solution and seek their own solutions to challenges they face along the way.

Relating to others

- Students will work on this project in groups. Effective communication, listening, cooperation and negotiation will be crucial for students to successfully complete this project.
- Students will learn to provide critiques on others' ideas in an appropriate way and take on feedback about their own ideas.
- Students may have the opportunity, as part of their design process, to engage with people outside of the school setting for advice. This will help to develop their understanding that often, when solving real-world problems, you need to collaborate with a variety of people in the community.

Participating and contributing

- Students are given the opportunity to engage with a real-world problem that affects members of New Zealand communities. Solving real-world problems gives students the opportunity to see how they can contribute to society and its betterment.
- Through working collaboratively to solve this problem, students are given the opportunity to understand that everyone has different strengths and that everyone's contributions, including their own, are necessary for the success of the team.

Learning Areas Levels 3 – 4

Science

Levels 3 and 4

Nature of Science

Understanding about Science

> Identify ways in which scientists work together and provide evidence to support their ideas.

Investigating in Science

> Ask questions, find evidence, explore simple models, and carry out appropriate investigations to develop simple explanations.

Participating and Contributing

> Use their growing science knowledge when considering issues of concern to them.

> Explore various aspects of an issue and make decisions about possible actions.

Living World

Life Processes

> Recognise that there are life processes common to all living things and that these occur in different ways.

Physical World

Physical Inquiry and Physics Concepts

> Explore, describe, and represent patterns and trends for everyday examples of physical phenomenon, such as movement, forces, electricity and magnetism, light, sound waves and heat. For example, identify and describe the effect of forces (contact and non-contact) on the motion of objects; identify and describe everyday examples of sources of energy, forms of energy, and energy transformations.

Material World

Properties and Changes of Matter

> Group materials in different ways, based on the observations and measurements of the characteristics chemical and physical properties of a range of different materials.

> Compare chemical and physical changes.

Chemistry and Society

> Relate the observed, characteristic chemical and physical properties of a range of different materials to technological uses and natural processes.

Mathematics

Level 3

Number and Algebra

Number Strategies

> Use a range of additive and simple multiplicative strategies with whole numbers, fractions, decimals and percentages.

Geometry and Measurement

Measurement

> Use linear scales and whole numbers of metric units for length, area, volume and capacity, weight (mass), angle, temperature, and time.

Statistics

Statistical Investigation

> Conduct investigations using the statistical enquiry cycle:

- Gathering, sorting, and displaying multivariate category and whole-number data and simple time-series data to answer questions;
- Identifying patterns and trends in context, within and between data sets;
- Communicating findings, using data displays.

Level 4

Number and Algebra

Number Strategies and Knowledge

> Understand addition and subtraction of fractions, decimals and integers.

Geometry and Measurement

Measurement

> Use appropriate scales, devices, and metric units for length, area, volume and capacity, weight (mass), temperature, angle and time.

Statistics

Statistical Investigation

> Plan and conduct investigations using the statistical enquiry cycle:

- Determining appropriate variables and data collection methods;
- Gathering, sorting and displaying multivariate category, measurement, and time-series data to detect patterns, variations, relationships, and trends;
- Comparing distributions visually;
- Communicating findings, using appropriate displays.

Technology

Level 3

Technological Practice

Planning for Practice

> Undertake planning to identify the key stages and resources required to develop an outcome. Revisit planning to include reviews of progress and identify implications for subsequent decision making.

Brief Development

> Describe the nature of an intended outcome, explaining how it addresses the need or opportunity. Describe the key attributes that enable development and evaluation of an outcome.

Outcome Development and Evaluation

> Investigate a context to develop ideas for potential outcomes. Trial and evaluate these against key attributes to select and develop an outcome to address the need or opportunity. Evaluate this outcome against the key attributes and how it addresses the need or opportunity.

Technological Knowledge

Technological Modelling

> Understand that different forms of functional modelling are used to inform decision making in the development of technological possibilities and that prototypes can be used to evaluate the fitness of technological outcomes for further development.

Technological Products

> Understand the relationship between the materials used and their performance properties in technological products.

Level 4

Technological Practice

Planning for Practice

> Undertake planning that includes reviewing the effectiveness of past actions and resourcing, exploring implications for future actions and accessing of resources, and consideration of stakeholder feedback, to enable the development of an outcome.

Brief Development

> Justify the nature of an intended outcome in relation to the need or opportunity. Describe the key attributes identified in stakeholder feedback, which will inform the development of an outcome and its evaluation.

Outcome Development and Evaluation

> Investigate a context to develop ideas for feasible outcomes. Undertake functional modelling that takes account of stakeholder feedback in order to select and develop the outcome that best addresses the key attributes. Incorporating stakeholder feedback, evaluate the fitness for purpose in terms of how well it addresses the needs or opportunity.

Technological Knowledge

Technological Modelling

> Understand how different forms of functional modelling are used to explore possibilities and justify decision making and how prototyping can be used to justify refinement of technological outcomes.

Resources and Materials

Supporting Resources

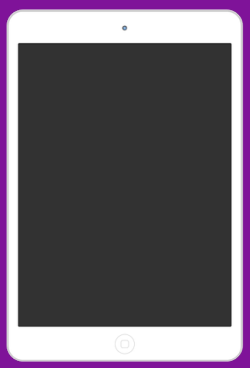
- SPCA Kids' Portal
- Caring for Animals
- Science Learn - Characteristics of Living Things
- TKI ESOL Teaching Strategies
- Canva
- Figure It Out - Level 3 - Well Weathered
- Figure It Out - Level 3 - Cold Coffee
- NZ Maths
- Science Learn - Heat Energy
- CK12 - Thermal Conductors and Insulators

Downloadable Resources

- Needs of Animals
- Five Domains Research Template
- Skills Flow – Importance of Food and Water
- The Design Process
- Log Book
- What is the Temperature?
- Kitten Growth – First 8 Weeks

Learning Experiences

Throughout the unit you will see these iPad icons. Each of these offers a suggestion on how you can incorporate the use of digital technology or the creation of a digital outcome into the learning experience. You may choose to incorporate all, some, or none of these, it is up to you! You may want to add in learning intentions and focus on particular digital skills in addition to the learning intentions included. Depending on your students' prior experiences with digital technology, it may also be necessary to spend time teaching them how to use the various digital tools so that they can do so effectively to complete the activities suggested.



Learning Experience 1: The Five Domains

Learning Intentions

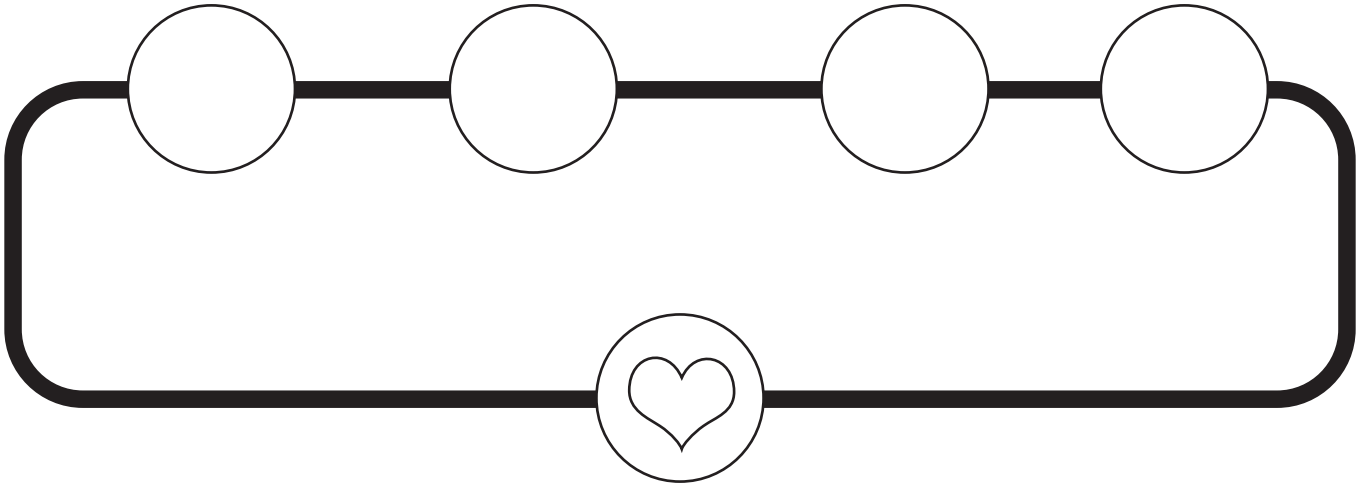
We are learning to…

- Gain knowledge and develop an understanding of the Five Domains
- Identify and describe the basic needs of a specific animal species.
- Explain the responsibilities that animal guardians (owners) have with regard to caring for their animals.

As this problem has its basis in ensuring animals have their needs met, is important that students have a good understanding of the needs animals have to have good welfare to begin with. The Five Domains Model can be used to consider what animals need for good welfare.

Begin the session by explaining to students that animals are sentient beings. They can think and feel and are aware of their thoughts and emotions. They are able to experience a range of positive and negative feelings including joy, pleasure, pain and fear. Given this, for animals to have good welfare, animal guardians need to take action to provide animals with what they need to have experiences that will have a positive impact on their feelings.

Draw the following diagram on the board.



Mental wellbeing (feelings)

Explain that this diagram is one way to represent something called The Five Domains Model. The Five Domains Model is used by SPCA to guide the way they care for the animals. It is a group of five things which help to ensure animals have good welfare and can help us to think about what animals need.

Explain that as just discussed, one thing that animals need is a good state of mental wellbeing (feelings), so that has been put into the diagram at the bottom. There are four other groups of things which are missing from the diagram. These are all things that will impact on an animal's feelings or wellbeing and things that also relate to an animal's basic needs for survival.

In pairs or threes give students 4 Post-It Notes and ask them to write down one thing on each that they think an animal needs to be happy and healthy and might fit into this diagram. Once students have completed this they will stick their Post-It Notes in a central area where a whole class discussion about everyone's different ideas can take place. Facilitate a discussion to group similar ideas together, for example ideas related to food and water could be grouped.

Use their ideas to reveal what belongs in the other four circles of the diagram – nutrition, environment, health and behaviour and explain each of these. You may like to use the Needs of Animals and/or Caring for Animals resources to support this explanation.

Have students reflect on what domains the needs they identified covered and if they missed any out.

Students now have a broad understanding of the Five Domains. Different animals have different specific needs that need to be catered for in relation to each of the domains. Students will investigate these further for specific animals.

This investigation will be carried out using a Jigsaw type strategy.

Organise your class into 4 equal groups – students will need to pair up in any unequal groups. This will be their 'home group' and each 'home group' will be assigned either nutrition, environment, health or behaviour. Each student within each home group will then be assigned an animal – animals can be pre-chosen by the class or the teacher can assign the animals.

Each student will then use the information on SPCA Kids' Portal to research what needs to be provided for the animal they have been assigned in relation to the domain their group has been assigned. They will also consider how the animal's mental wellbeing (i.e. how they would feel) would be impacted if

they were to have all of the things they have listed. Therefore, every child in the class is researching something different. You can download the Five Domains Research Template for students to record their information on.

Once students have completed their research about their assigned domain, for their assigned animal, the groups will reorganise themselves and they will meet with others who had the same animal as them. This is their 'expert group'. Students will share what they found out about their specific domain so that everyone as a group can complete the template for all of the domains for that animal.

With their new information students then return to their 'home group'. Everybody in the group takes a turn to share the information they have about their particular animal. Now everyone in the class has learnt about a range of different animals' needs.

Group Structure Example:

Each number represents a different student.

Home Groups			
1 - Chicken	6 - Chicken	11 - Chicken	16 - Chicken
2 - Rabbit	7 - Rabbit	12 - Rabbit	17 - Rabbit
3 - Sheep	8 - Sheep	13 - Sheep	18 - Sheep
4 - Cat	9 - Cat	14 - Cat	19 - Cat
5 - Cow	10 - Cow	15 - Cow	20- Cow

Expert Groups				
Chicken	Rabbit	Sheep	Cat	Cow
1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20

Student 1 was assigned to the nutrition home group and was then assigned chickens. On their template Student 1 will record what information they can find out about what animal guardians (owners) need to do to ensure their chickens are provided with good nutrition and how chickens who are provided with these things would feel. When the groups reorganise into their expert groups Student 1 will meet with other students who were assigned chicken as their animal. Student 1 will share what they found out and will then listen to other students share their information about the other domains in relation to chickens. Now Student 1 knows about the needs of chickens in relation to all of the domains and will return to their home group. They will share what they know about chickens with Students 2, 3, 4 and 5 and Students 2, 3, 4 and 5 will then share their information about rabbits, sheep, cats and cows. Now through learning from their peers and having only researched one small part Student 1 knows about the Five Domains in relation to five animals.

2. Nutrition

Learning Intentions

We are learning to…

> Understand why food and water are necessary for animals to stay healthy.

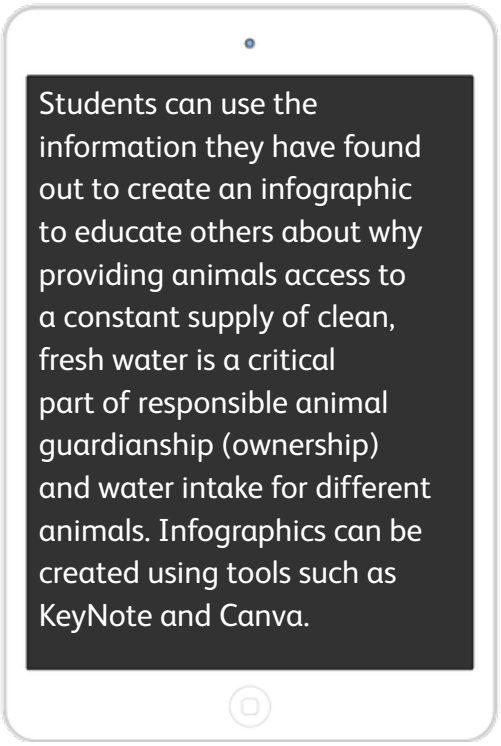
> Understand animals different water consumption needs.

As this problem is based in helping to ensure that animals access to water isn't restricted it links to the nutrition domain. Students will learn the scientific reasoning behind why animals, as living things, need food and water to survive and the water needs of different animals.

To communicate this information to students about the importance of food and water for animals, teachers can carry out a skills flow activity. Instructions for completing a skills flow task can be downloaded from TKI ESOL Teaching Strategies. Download Skills Flow – Importance of Food and Water for the necessary text and images.

The reasons given in this activity relate largely to the physiological reasons why food and water are essential for animals. Ask students to reflect on the impact food and water can also have on mental wellbeing and an animal's mental wellbeing. How do they feel if they haven't had anything to eat or drink for a few hours? Is their mood affected by their hunger and thirst? How do they feel after they have eaten a meal or had a drink? Does eating different types of foods give them different experiences, for example, what is the experience of eating their favourite food like?

Following this, students will research the amounts of water that different animals drink in a day. The SPCA Kids' Portal is a good place for students to begin their research.



Learning Experience 3: The Problem and Design Brief

Learning Intentions

We are learning to…

> Define a problem or a need to guide our technological practice.

> Develop a design brief that will describe the intended outcome and the attributes it must have.

Introduce the design process to your students. You can download a copy of The Design Process.

Refer back to the research that has been done around nutrition for animals and explain that one problem some people face in regard to this is that their animal's water sources freeze when it gets very cold. They have to monitor their animal's water source more carefully to check that they still have constant access to drinkable water. They will be designing a solution that may be able to solve or alleviate this problem.

Following this you can begin to co-construct the design brief with your students. The design brief will be added to and revised as students begin the investigation phase of the design process. Explain to the students that the design brief will be there for them to check against as they move into the process of developing their solutions. They will also use it at end to evaluate their solution.

Some ideas to consider for the design brief:

> Choosing a water bowl/water trough for an animal that would have a problem of a frozen water supply.

> It needs to be strong enough so that the animal it is being designed for won't tip it over.

> The material needs to be durable enough to withstand being outside.

> The size needs to be appropriate for the animal it is being designed for.

> It needs to be safe for the animal to drink from i.e. they can't fall in.

> It needs to be easy to clean and be kept clean.

Learning Experience 4: Investigation

Learning Experience 4A: What's The Problem?

Learning Intention

We are learning to…

> Conduct research to develop our understanding of the context to support us to develop ideas for potential outcomes.

Organise students into the small groups that they will be working with to develop a solution to this problem. Students should be grouped in a such a way that each group has students with diverse areas of strength that they can contribute to the team.

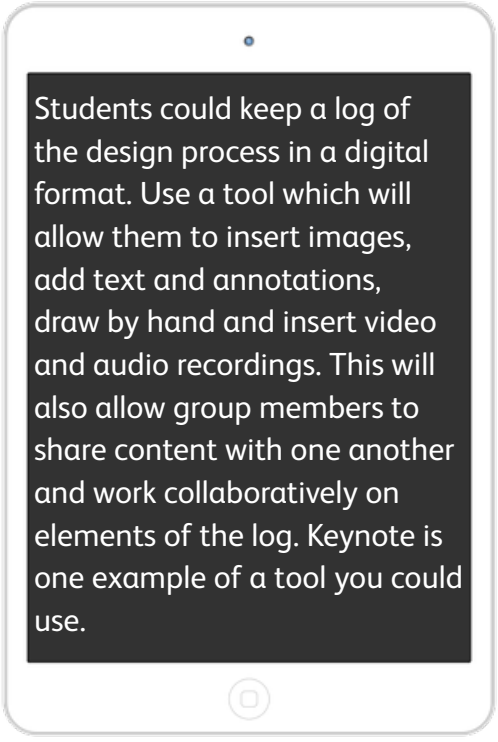
Students can begin their research into this problem individually and then share their findings with their group.

Much of the information that can be found through internet research will give students information about how people already try to combat this problem. This will support them in being able to start thinking about designing their own solutions.

At this stage, students can also begin keeping a record of their progress. You can download the Log Book for your students to use, which will track their progress throughout the design process, or you can use your own form of recording.

If possible, students should gain some stakeholder feedback on this issue as part of their research. Students may be able to find members of their community who have experienced this problem to discuss it with. They may also be able to speak with someone from an organisation that makes animal water source products to discuss water bowls and troughs that are already on the market. This could be carried out via a Skype interview, emailing them or inviting them to come and speak to the class.

After this research has been conducted it may be a good time to



revisit the design brief now that students have a wider understanding of the problem. They may have suggestions of key attributes that they hadn't been aware of before.

The following learning experiences are designed to be used flexibly by teachers. A series of activities has been suggested to help introduce important scientific and mathematical concepts that will support students to be successful in developing their solutions. Determine your students' level of prior knowledge of these concepts to decide whether these need to be used in full and/or whether further instruction needs to be provided beyond these.

Learning Experience 4B: Temperature and Graphs

Learning Intentions

We are learning to…

- Recognise the need for a standard unit of temperature.
- Measure temperature (degrees Celsius) using a thermometer.
- Calculate changes in temperature.
- Display time series data using the appropriate graph.
- Interpret and make statements about data shown in a graph.

Have students share their ideas around why people need to measure temperature and how they measure temperature.

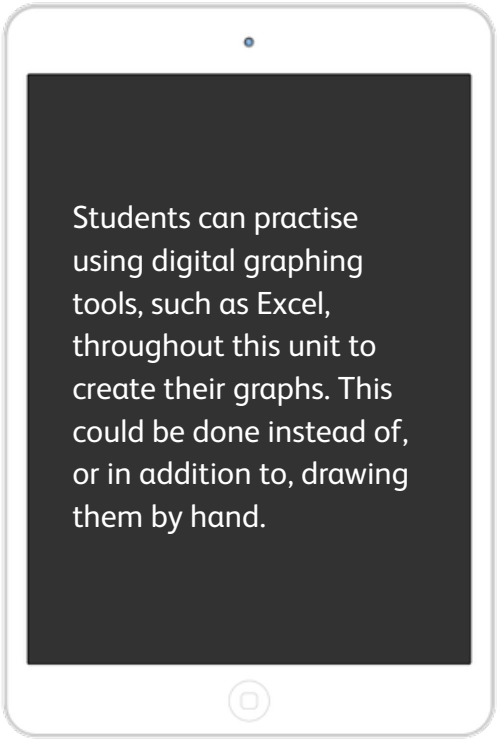
If temperature is a completely new concept for your students, give them time to explore different thermometers and temperature.

Give students the opportunity to measure, record and compare different temperatures with a thermometer. You can download the What is the Temperature? sheet and set up the relevant items for students to measure the temperatures of.

Students will be recording their time series data using line graphs. Show students the Kitten Growth – First 8 Weeks line graph and have them Think-Pair-Share what they notice about the graph.

Scaffold students as necessary to work through Figure It Out - Level 3 - Well Weathered to practise interpreting and drawing their own line graphs.

If students need further practise with either temperature or line graphs before applying these concepts in the next activity, you can provide further activities to consolidate this learning. Figure It Out - Level 3 - Cold Coffee Activity One could also be used. Go to NZ Maths for a range of extra learning experiences.



Learning Experience 4C: Insulator or Conductor?

Learning Intentions

We are learning to…

> Describe what heat energy is and how it is transferred.

> Explain what a thermal insulator is.

> Explain what a thermal conductor is.

> Investigate and compare the effect of different materials on temperature.

> Explain why different materials are used for specific purposes.

Introduce students to the concept of energy and heat energy. Refer to Science Learn - Heat Energy for further information. Link back to the problem – when the air temperature is colder than the water and water bowl/trough, the water and the water bowl/trough will lose their heat energy.

Ask the students to think about whether they think that heat energy can move in the same way through all materials. Have students line up down the middle of the classroom. The teacher will then list a variety of materials that are either thermal insulators or thermal conductors. Students will determine whether they think the material allows heat energy to pass through easily or not. They will step forwards if they think heat will move through it easily and backwards if they think it won't. You could select children to justify their reasoning with reference to examples – example, someone might be sure that metal is a thermal conductor because you need to use a tea towel to lift off a pot lid with a metal handle. Build on this discussion to introduce students to the vocabulary thermal insulators and thermal conductors, if it has not already been said by students. Refer to CK12 - Thermal Conductors and Insulators for further information and videos.

Students will now be given the opportunity to investigate the transfer of heat energy and thermal insulators and conductors themselves, in the groups that they will be designing their solution with. You can either facilitate the following experiment or allow students to derive their own experiment to test the thermal conductivity of a variety of materials.

This is also an opportunity to integrate learning intentions related to the Nature of Science strand of the curriculum.

We are learning to…

> Find evidence to support our ideas.

> Ask questions and carry out experiments to develop explanations.

> Explain the connection between our scientific knowledge and the problem we are trying to address.

> Use our scientific knowledge to help us make decisions when developing our solutions.

Provide the groups with containers made of a variety of materials (metal, plastic, ceramic, double walled, rubber, wood, something wrapped in fabric, etc.). Students can make a hypothesis about which of the materials will keep a cup of water warmest for the longest period of time. Pour the same amount of heated water into each of these containers. Depending on the availability of containers, this may be an opportunity to discuss fair testing with the students with regard to the size, shape and volumes of the various containers. Students can then measure the temperature of the water in each at timed intervals. This data can be recorded and graphed. It may be beneficial to graph all materials on the same axes so that students can compare the temperature decreases of each of the materials.

You could extend on this experiment by investigating what differences there are if a larger or smaller

surface area of the water is exposed and not covered by the material. You could also extend on this experiment by investigating whether the colour of the material used impacts on how well the water retains its heat. Encourage students to ask their own questions that they could test that will be relevant in developing the scientific knowledge they will use to develop their solutions.

Learning Experience 5: Developing Solutions

Learning Intention

We are learning to…

> Use the design brief and the information that we have collected to develop potential solutions in response to the problem.

At this stage the students should consider and record all ideas for potential solutions to this problem as they will refine these in the next step of the process. Ideas can be recorded in their Log Book.

Learning Experience 6: Choosing A Solution

Learning Intentions

We are learning to…

> Reflect on and evaluate our ideas in relation to the design brief.

> Choose and justify an appropriate solution for the problem.

> Develop a plan and identify the resources needed to produce an outcome.

Before students choose their solution this may be another useful time to revisit the design brief. After looking at some of their potential solutions from the previous activity you may realise that some further specifications may need to be put in place around the cost and feasibility of designs, if these have not been addressed already.

At this stage, students may also want to carry out further experiments to test the effectiveness of various other methods they may have found as part of their research. For example, some people try to keep the water in the trough or bowl agitated to slow the freezing process.

With the design brief available to them, students will now work together as a group to choose the solution they want to pursue.

Some of the following question prompts may be useful when conferencing with your students about their solution to help them think critically and think about why they believe their idea is an appropriate solution:

> What are the advantages of your chosen solution over the other ideas you brainstormed?

> Are there any disadvantages of your chosen solution? How could you reduce these?

> Does your proposed solution meet all aspects of the design brief?

> What different opinions did people in the group have? How were these resolved and taken into consideration?

Students will also develop a plan to help them structure the time that they will have to work on creating their prototypes. Explain to students that these will most likely end up being adapted once they begin due to unexpected challenges but that they still need to have a plan in place before they begin.

Learning Experience 7: Models and Prototypes

Learning Intentions

We are learning to…

> Create a prototype of our solution using our plan.

> Evaluate the prototype throughout the process of creating it to further refine the outcome.

> Revisit our plan when creating the prototype and record any necessary changes and their consequences.

Students will now engage in the process of designing a prototype. Students may need time during this process to go back to an earlier stage if they encounter unexpected challenges. For example, students may realise that the way they had planned to attach different components of their water bowl/water trough together are not strong enough and they need to go back and conduct some research on more suitable adhesives.

There is space in the Log Book for them to record what they have achieved each session, what challenges they faced and what actions they need to take to try and overcome that challenge. This section also requires them to reflect on how their team is working together to promote students to be conscious of how to work effectively with others.

Learning Experience 8: Testing and Evaluation

Learning Intention

We are learning to…

> Test and evaluate the effectiveness of our solution to the problem against the key attributes in the design brief.

Students can now test their water bowl/water trough prototypes to determine their ability to keep water from freezing or slow the freezing process.

If it is possible, depending on your location and the time of year, allow students to test their water bowls/water troughs outside and measure the temperature changes over a period of time. They can then graph their results and compare the rate the temperature dropped with a control container of water.

If it is not possible to test their prototypes in an authentic setting, try to find a way they can be tested in a cold environment such as a freezer (depending on the size) or an ice bath. They can then graph their results and compare the rate the temperature dropped with a control container of water.

Provide students with a copy of the design brief. They will then go through each of the criteria on it to determine if their water bowl/water trough has met the criteria. The Log Book also contains some reflection questions.

The Needs of Animals

The Five Domains are five groups of things animal guardians need to consider when thinking about good animal welfare. These consist of:

Nutrition

Just like it is for us, a complete and balanced diet is one of the most important factors in ensuring healthy growth and development and maintaining overall good health of your animals.

Food

The proper amount of food and balance of nutrients is essential when feeding your animals. Just like us, animals need a certain combination of protein, carbohydrates, fats, vitamins, minerals and water every day in order to grow, develop and stay healthy and strong.

Eating should be an enjoyable experience for animals, this includes offering a variety of textures, tastes and smells.

If animals are being fed processed food such as dry food or pellets, it is important to follow the recommended daily amounts provided on the packet labels. Just as there are underweight animals, there are many overweight animals whose bodies work extra hard to stay alive. Deposits of fat make it hard for the animals' blood to flow efficiently. As a result, the supply of oxygen to the animals' muscles and organs is reduced and their bodies no longer function well. The animals live in pain and discomfort and their life expectancy is shortened.

Keeping your animals active and at a healthy weight will increase their lifespan and the time you get to spend together. Different animals have different nutritional requirements. It's always wise to discuss the best diet for each of your animals with your veterinarian. Ensuring you are giving your animals the right food, in the right amounts will help to keep your animals in good health.

Water

Just like us, animals need fresh water available at all times. Water allows an animal's body to function properly and to deliver important nutrients throughout their system.

Water helps an animal stay hydrated and controls their body temperature, especially on hot days. Water must be fresh. If it has been sitting around for a while, water gathers germs and parasites that may be harmful. Remember to refresh animals' water bowls at least twice a day. Never allow water bowls to remain empty, freeze or get too hot.

Don't forget to also clean your animal's water containers every day.

Environment

All animals should live in an appropriate environment. The conditions and surroundings given to an animal contribute to their overall wellbeing. By providing an animal with shelter, a comfortable resting area and a large, safe space to express natural behaviours, you are helping that animal to remain healthy and happy.

Shelter

Just like people, animals need places where they are sheltered from wind, rain and hot sun. Some animals, such as guinea pigs and rabbits, also need shelter to protect them from predators like cats and dogs. Enclosures, kennels, hutches, houses and aviaries provide shelter for our pets while barns, stables and sheds protect farm animals.

If an animal's shelter is also their home, it must be as comfortable as possible. It must also be as large as possible, with attached areas for exercise and opportunities to express natural behaviours. Bedding within the shelter should always be soft, warm, dry and cleaned regularly. An animal's environment needs to be interesting, enriched, and safe.

Health

All animals should be entitled to immediate veterinary attention when they are sick or injured. To avoid unnecessary suffering, animals should be taken to a veterinary clinic when sick or injured and treated accordingly. In most cases, unnecessary pain and injury can be prevented through regular visits to a veterinarian.

Medical (Veterinary) Care

Just like when we visit the hospital or dentist, for many animals, a visit to a veterinary clinic can sometimes be a little bit scary. Regardless of how enjoyable or not the experience is, animals should visit a veterinarian at least once a year for a health check-up and vaccinations against a range of infectious diseases. Ensuring your companion receives preventative medical care is part of being a responsible animal guardian. It is essential to ensuring your animal has good health.

Good health means gentle, careful handling, the rapid diagnoses of disease and injury, space and opportunity to enjoy physical activity and natural behaviours, and keeping a healthy weight.

If animals show any signs of pain, injury or ill health, it is important they receive veterinary care immediately. An indication that an animal may be ill could include:

> loss of appetite
> sluggish behaviour/difficulty moving around

- rapid weight loss
- vomiting
- diarrhoea
- discharge from ears, eyes or nose
- lumps or bumps

Vets can also advise on how to prevent and rid animals of fleas and worms. Fleas are small, biting, blood sucking insects that cause animals to scratch. If they are not removed, the animals may suffer from an irritating skin condition. Very young animals such as puppies and kittens, and elderly pets can become anemic and even die from flea infestations that are left untreated.

Roundworms, tapeworms and hookworms are parasites that live in the digestive system, arteries and heart of an animal. Infestations of worms can be fatal. A number of treatments are available; a veterinarian will recommend the most suitable treatment for your companion animal and give you advice on scheduling these treatments regularly so these parasites don't become a problem.

Behaviour

All animals should be able to express their natural behaviours. Behaviour refers to the way an animal acts. An important type of behaviour that an animal expresses are those that are instinctive (what they would typically do in the wild). Enough space, proper shelter and housing, as well as company of the animal's own kind, encourages the expression of natural behaviours.

Exercise

Exercise keeps animals healthy and alert, just like it does for you. Blood flow is increased during exercise, clearing arteries and veins and transporting oxygen and nutrients around the body.

Exercise keeps muscles strong, allows better digestion of food and heightens an animal's senses. Energy that has been stored as fat can also be used up during exercise - this helps to prevent animals from becoming overweight.

Expressing natural behaviour is not only about an animal exercising their body, it is also about an animal exercising their mind. During exercise, new sights, sounds, smells and tastes can be discovered; unknown paths, trees and tunnels can be explored and new animals may be encountered - these experiences are very important for an animal's physical and mental well-being.

Enrichment

Imagine if you spent your entire life alone, locked in a big room. You had food, water, a warm cosy bed and once a day you were let out for 30 minutes to run around, but that was all. You had no friends, no toys, no TV, no books, no phone, no internet. What would or could you do for the rest of the day? How do you think you would feel?

Most people would experience loneliness, boredom, frustration, sadness, anger and depression. Animals are likely to feel the same way too. Animal guardians must meet their companion animal's

environmental and behavioural needs – this includes providing mental and physical enrichment.

Animal enrichment is about designing and creating interesting enclosures, and providing activities that create a more stimulating environment for an animal. Enrichment should enable them to express as many of their natural behaviours, such as exploration, foraging, locomotion (movement), social interaction, manipulating objects or simply playing, as often as they choose.

Good enrichment is safe, fun, challenging and time consuming.

Be sure to check out the **Things to Make or Do** section for examples of some awesome DIY enrichment toys!

Companionship

There are many natural behaviours that animals will express when they have companions of their own kind such as grooming, playing, and cuddling. Even with lots of human contact, many animals need to live with a compatible companion. Without a friend to carry-out these natural behaviours, an animal can become frustrated, bored, and lonely. They can even develop abnormal behaviours if left without company and nothing to do for long periods.

No one understands an animal quite like a member of their own species! When animals have companions of their own kind with which they can express these natural behaviours, it helps them to feel safe, happy, and content.

Get to know your animal and their companionship needs so that you can help them express their natural behaviours.

Mental Wellbeing

Positive mental experiences means having positive feelings and experiences. These include experiences of comfort, pleasure, interest, confidence and a sense of control.

The four domains of health, behaviour, nutrition and environment all impact on the overall mental wellbeing (feelings) of an animal. For example:

Nurition

Experiencing tasty, varied food and fresh water

Feeling full and satisfied because of good food and water

Environment

Experiencing fresh air, comfortable bedding

Feeling warm and comfortable in their environment

Health

Experiencing good fitness

Feeling healthy and energetic because of good health

Behaviour

Experiencing appropriate social interactions

Feeling affection, joy because of appropriate behaviour

Five Domains Research

Fill in the information you find out about the domain you have been assigned into the appropriate box. Also fill in how the animal would feel if they had all of their needs met for that domain. When you meet with your expert group, fill in the information they have about each of the other domains into the appropriate boxes.

Nutrition

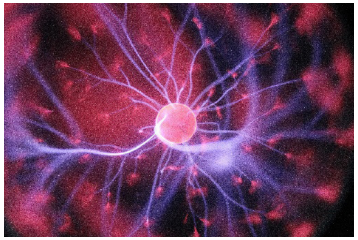
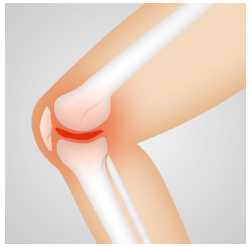
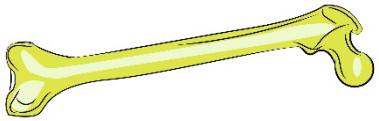
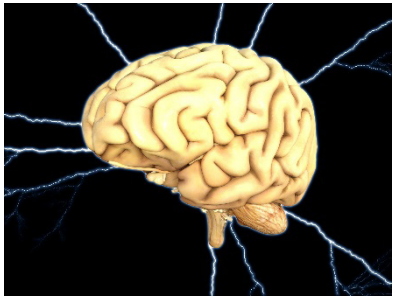
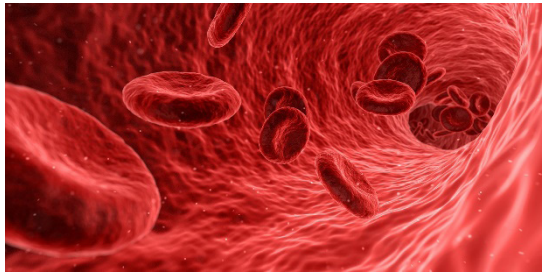
Environment

Health

Behaviour

SPCA Education

Skills Flow – The Importance of Food and Water

Number: 	Number: 	Number: 
Number: 	Number: 	Number: 
Number: 	Number: 	Number: 

Images sourced from Pixabay and Hal Gatewood on Unsplash.

SPCA Education

Statements for Teacher:

1. The nutrients in food get converted into energy so their bodies and brains can function.
2. The nutrients in food also help animal's bodies to fight off infections and illnesses.
3. Protein helps to build muscles, grow new tissue and repair old tissue.
4. Water helps animals control their temperature so that they do not get too hot.
5. Water helps to produce salvia and animals need saliva to break down and digest the food they eat.
6. Water is needed to help blood move the nutrients they get from their food around their bodies.
7. Chemical reactions occur in all living things and water is necessary for chemical reactions to occur that release energy for the body to function.
8. Joints are where bones meet and in between bones is a substance called cartilage, which is mostly made of water.
9. Cartilage between the bones helps them to move freely without the bones wearing down.

The Design Process

The Design Process

Most engineers, designers and inventors follow a simple 8-step process when designing; this is called the design process. Following this process will help you design your solution.

The problem

The process of a design begins where there is a need or when an improvement of an existing product is required.

The design brief

This states what is to be designed. The design brief must be very simple and clear.

Investigation

In this step the designer must understand what information is needed to realise the design. This information must then be collected. Questions to be asked might include, what is the function? What should the appearance be? What materials are available or required?

Developing solutions

In this step ideas should be discussed and recorded. All ideas should be written down and kept, do not be critical of each other! The more ideas there are, the easier it will be to come up with a solution. In this step you should try to be imaginative in your ideas.

Choosing a solution

The ideas should be studied and the one that best meets the design brief should be chosen as the solution. This solution will also need to meet any restrictions in time, costs or materials available.

Models and prototypes

In this step a model (full-sized or scaled down) is built to understand and communicate the idea. A prototype is a working version of the solution which can then be tested to make sure it works.

Testing and evaluation

During this phase the prototype is tested to make sure it works and that it meets the design brief. This phase will also allow the designer to see if any modifications are needed to improve the solution.

Manufacturing

Once everyone is happy with the design and knows that the product will sell, it must be manufactured. Depending on the product it might be mass produced or it might be a specially constructed product that is hand-made.

Log Book

This log book is for you to record your progress as you work through the design process. Part of it will be completed individually and part of it will be completed with your group. Make sure that you date each of the entries you put into your log book so that you can keep track of your progress and make sure that you are meeting the deadlines.

The Problem

What is the need or opportunity that you are addressing?

The Design Brief

**Teachers – make a copy of the design brief available for students to keep with their log book and refer back to throughout the process.*

Investigation

Record any useful research findings below.

Teachers – provide additional pages if necessary.

Developing Solutions

Record all ideas for potential solutions below.

Choosing A Solution

What animal are you designing your water bowl/ water trough for?	
Give a short description of your water bowl/water trough and the key features that it has to address the problem.	
What materials will you require for your water bowl/ water trough?	
Why have you chosen to use these materials?	
How does your water bowl/ water trough ensure that the animal will be safe when drinking from it?	

Draw and label a diagram of what your water bowl/water trough will look like.

The following chart will help you to plan out the way you will use your time when creating your prototype. Discuss with your teacher the amount of time you will have to work on this.

Date:	Tasks we will work on:

Models and Prototypes

Date:	
What did your group work on/achieve today?	
Did your group face any challenges or anything unexpected today?	
What is your group planning to do to overcome these challenges?	
What do you think was successful about the way your team worked together today?	

Date:	
What did your group work on/achieve today?	
Did your group face any challenges or anything unexpected today?	
What is your group planning to do to overcome these challenges?	
What do you think was successful about the way your team worked together today?	

**Teachers – make further copies of this sheet available as necessary.*

Testing and Evaluation

**Teachers – provide a copy of the design brief with a self-assessment column added in for each of the key attributes.*

Use the self-assessment column on the design brief to assess whether or not you think your group's prototype meets all of the key attributes.

If it did not meet all of the key attributes, what key attributes were not met and why do you believe this happened?

Is there anything that you feel you could have changed about the solution and prototype you designed? What things would you change and why?

What do you believe allowed you and your group to be successful during the design process?

What is the Temperature?

In the following chart, record the temperature of each of the items listed. You will then use this information to answer questions that are below.

	Temperature ^{0}C
Water with an ice cube in it.	
Water that has been sitting in the sun.	
Water from the hot tap.	
Water from the cold tap.	
Water that has been in the fridge.	
Water that has been left at room temperature in a shady spot.	

1. What was the difference between the hottest and coldest temperatures you recorded?

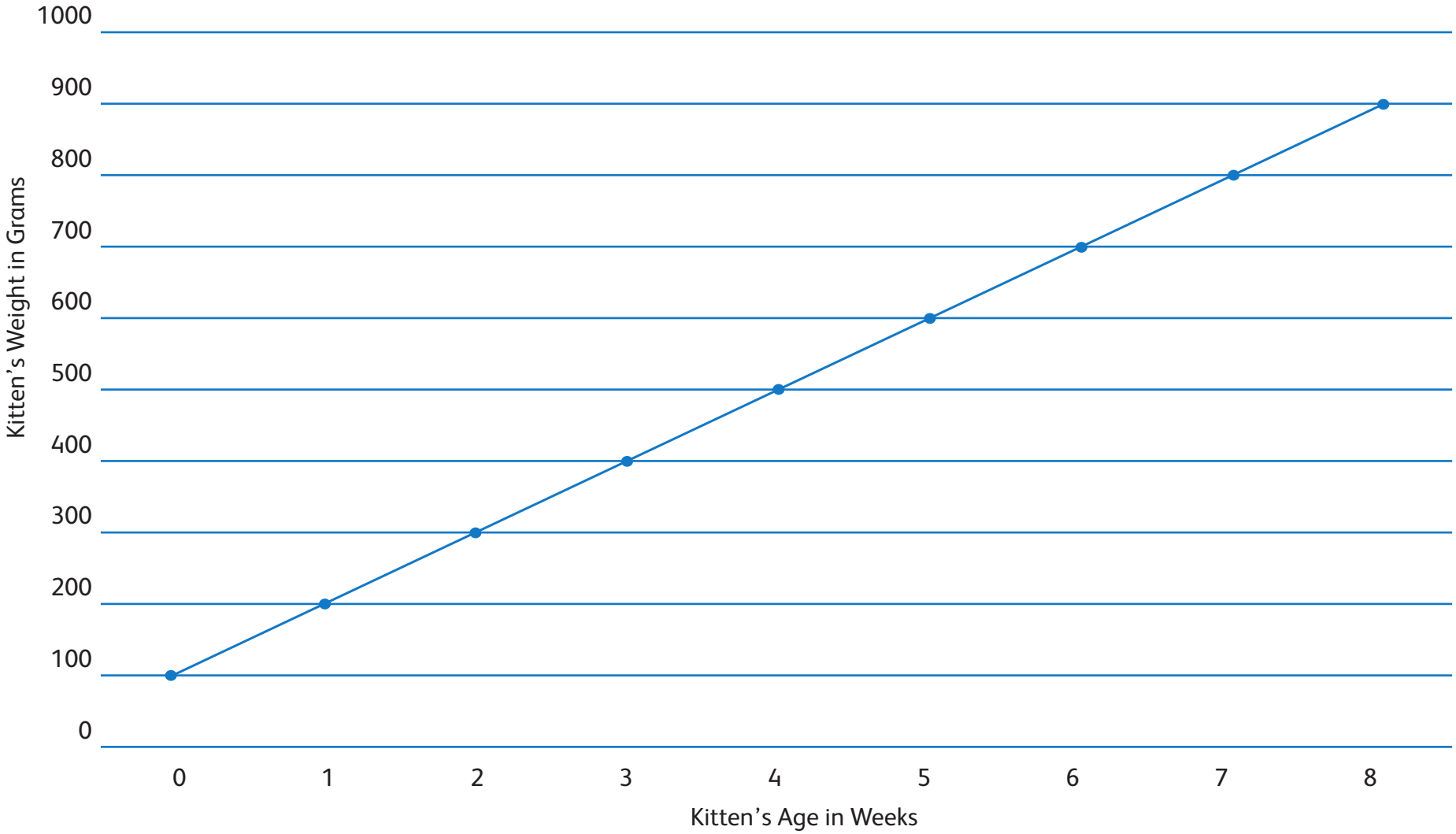
2. What was the difference between the temperature of the water from the cold tap and the water with an ice cube in it?

1. What was the difference between the water that was sitting in a sunny spot and the water that had been left at room temperature in a shady spot?

2. What was the difference between the temperature of the water from the hot tap and the cold tap?

3. What two types of water have the temperatures with the smallest difference? What was the difference between their temperatures?

Kitten Growth - First 8 Weeks



SPCA Education