If research poses a risk to people or nature, should we still go ahead with it?

Performance Activity: Future Thinking

Select one of the Scientific Scenarios below or choose your own scenario.

Divide the class into 4 groups and give each group 5 minutes to create an innovative solution to the scientific scenario, which may itself pose potential risks. It doesn't have to be scientifically realistic- invite students to be as creative as they like!

Along with the idea, each group must also come up with a catchy title and a media-friendly strapline for their solution.

Each group then reads their title & strapline to the rest of the class. The class votes on which idea they want to hear more about.

The group with the winning idea now has 60 seconds to expand on their proposal to the class, explaining why their idea should be made a reality. It may help to get students to imagine they are pitching for funding to bring their ideas to reality.

Having heard the pitch, the other three groups then each take on one of the following roles. Give them 3 minutes to think about their arguments:

- Beneficiaries in 50 years' time. They have 60 seconds to say why the idea has been so good for them 50 years on.
- Critics in 50 years' time. They have 60 seconds to say why the idea has been so bad for them 50 years on.
- Panel of judges. They must weigh up the evidence from Beneficiaries & Critics to make a final decision as to whether the scientific solution should be developed or whether it is too risky.

15 minutes

Role play

Anticipating risk; Examining consequences; Creative thinking; Collaborative problem solving.

If research poses a risk to people or nature, should we still go ahead with it?

Science and Society Questions

See suggested Scientific Scenarios to use with these questions.

- What would happen in the future if the research to find a solution to this problem didn't go ahead? How would society lose out?
- Can you think of potential damage the research could cause? Do you think the benefits of this research outweigh the risks?
- Could we ever consider all the potential consequences of the research solution? How can we decide whether the solution should be developed if we can't know for sure what the consequences will be?

Scientific Scenarios

Earth's resources
Every single piece of plastic ever made still exists, and this plastic is causing harm to animals and nature. Scientists are currently researching solutions: alternatives to plastic and ways to reduce or better recycle the plastic we use, but plastic alternatives and reduction methods could create their own problems.

Disease
There has been an outbreak of a new disease that is causing an epidemic across the world. Scientists must find a way to combat and control the epidemic, but each combat and control method could carry risk.

Who should be involved in deciding which research projects get developed?

Performance Activity: Future Thinking (extended version)

Select one of the Scientific Scenarios below or choose your own scenario.

Divide the class into 4 groups & give each group one of the following identities; Global (World Leaders, UN, religious leaders etc), National (politicians, media, big businesses etc), Social (teachers, medics, police, shop keepers etc) and Domestic (families of all generations; parents, carers, children).

Each group must take on the viewpoint of their identity. Announce to the class that you have all travelled 50 years into the future. Give the groups 5 minutes to discuss the positive and negative impacts the scientific scenario has had on their group.

Acting as a news reporter, visit each group asking for their views: How has it benefited your community? Have there been any negative consequences to your job? How has your life changed since? Be as playful with this as you like.

To finish, get the class to vote on whether the Scientific Scenario was a good idea.

Get them to vote twice: once in character and then from their own personal viewpoint.

15 minutes

Characterization

Examining consequences; Considering ethics; Emotional intelligence; Collaborative problem solving.

Who should be involved in deciding which research projects get developed?

Science and Society Questions

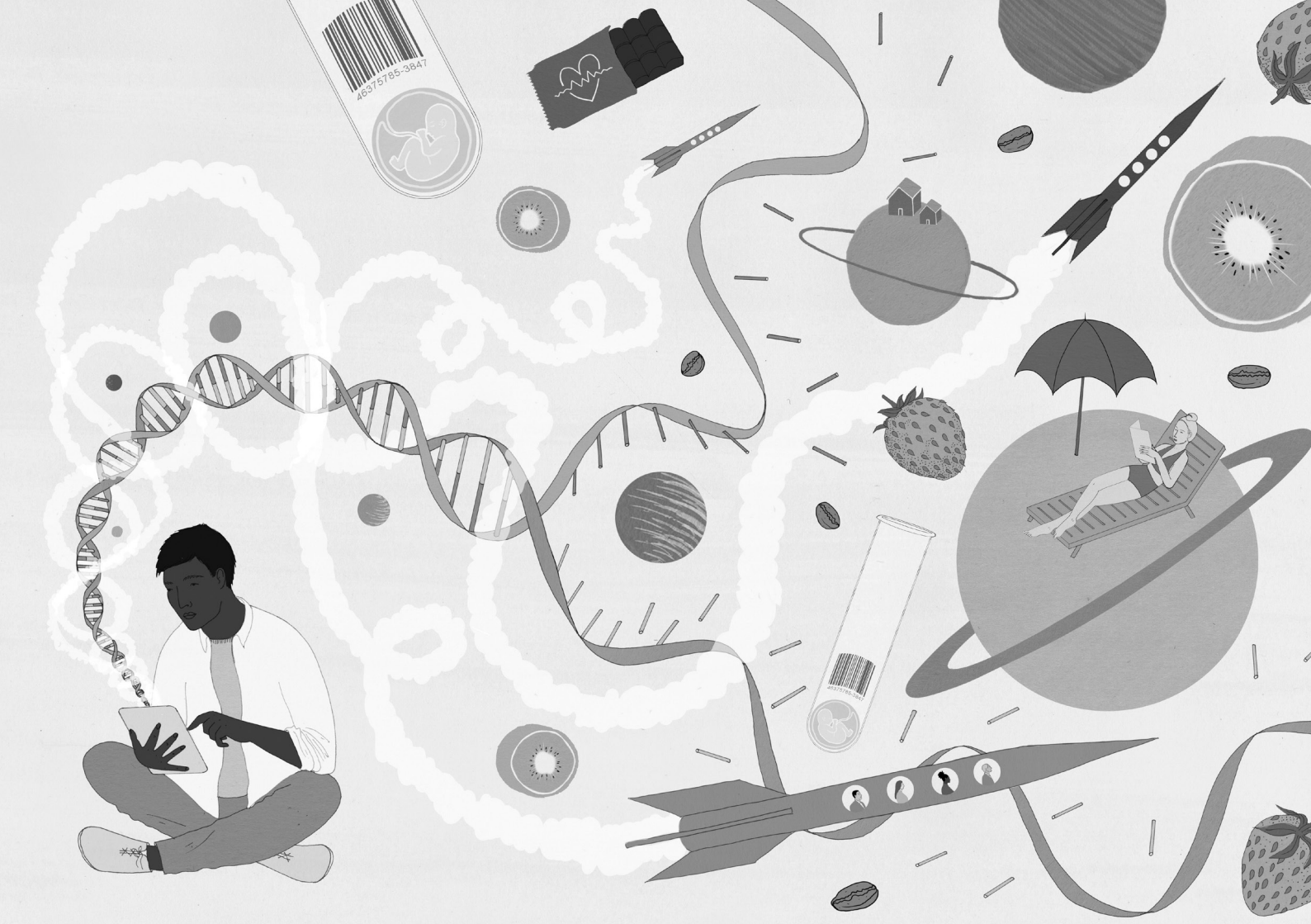
See suggested Scientific Scenarios to use with these questions.

- Who will benefit most from this situation? Is any group of people going to be negatively affected by this situation?
- Who should be involved in making decisions about the situation? Should only the scientists working on this research or only people who will be directly affected have a say?
- If the public doesn't want this to happen but scientists do, whose opinion should be valued more?

Scientific Scenarios

Energy
Scenario 1: 50 years in the future, our society is dependent entirely on renewable energy.
Scenario 2: 50 years in the future, our society is dependent entirely on fossil fuels.

Universe
50 years in the future humans have discovered a habitable planet, people are trying to decide whether we should be allowed move there.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Should we believe everything we read about science?

Performance Activity: Unbelievable Truth

Choose a topic that your class is revising, or one of the Scientific Scenario Topics below.

Give students 5-10 minutes to prepare a 1-minute presentation on a scientific topic. The presentation should consist entirely of made-up facts, apart from three concealed truths.

Invite a few students to present their 1-minute presentation to the class or smaller groups. Whilst the student presents what they have prepared, the listeners must listen carefully and stop the speaker if they think they hear a truth.

Listeners get a point for every correctly detected truth. The speaker gets a point if the listeners mis-identify a truth or fail to spot a truth.

Follow up questions:

- How easy was it to spot a truth?
- Which fake facts sounded more convincing? Why?
- Why did you believe some facts more than others?
- What helped you spot certain facts?
- Not everything reported about science in newspapers and online is true. Why do you think people might find it hard to tell the difference between true and false claims?

20 minutes

Self-narration

Critical thinking and reasoning; Interrogating sources; Listening skills.

Should we believe everything we read about science?

Science and Society Questions

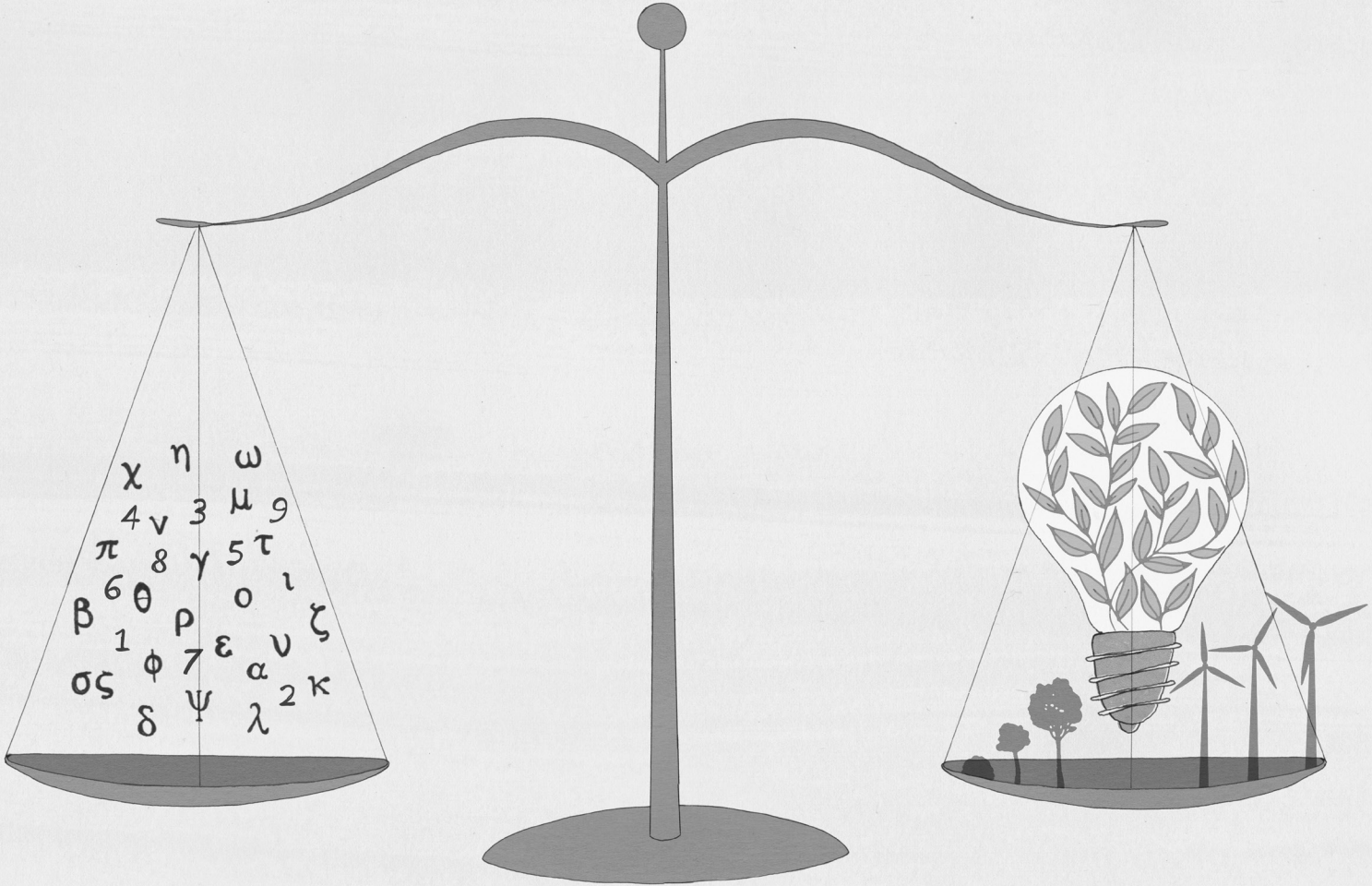
See suggested Headlines from the Scientific Scenarios to use with these questions.

- Why do you think there are claims in the media that aren't true?
- Who is responsible for untrue claims about science in newspapers and online? Who might have a motive to influence what is reported?
- Why do you think it matters if untrue claims about science are reported?
- If people don't know what to believe, how might this affect their perception of science?

Scientific Scenarios

Use 'Topics' for the Performance Activity and 'Headlines' for the Science and Society Questions.

Topic	*Headline*
Robots	Robots are taking over human jobs
Genetics	Design your own baby
Nutrition	Chocolate helps you live longer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Should research always provide a direct benefit to society?

Performance Activity: The Mystery Object

Students should work in pairs or threes.

Option 1: Give the class 1 minute.
Each group must choose a random object from the classroom.

Option 2: You choose a random object for the whole class.

This object is now their scientific invention and each group must tell a story about it. It doesn't have to be scientifically realistic – invite students to be as creative as they like! Give students 3 minutes to prepare and then 1 minute to present their invention to the class.

After the inventions have been presented, discuss with the rest of the class:

- Which inventions will affect our future the most?
- Which inventions will have the most positive consequences? Which inventions will have the most negative consequences?
- If we could only develop one invention, which should we choose? Should we choose one that solves a world problem?

10 minutes

Prop-use

Critical thinking and innovation; Communicating ideas; Creative problem solving; Using initiative

Should research always provide a direct benefit to society?

Science and Society Questions

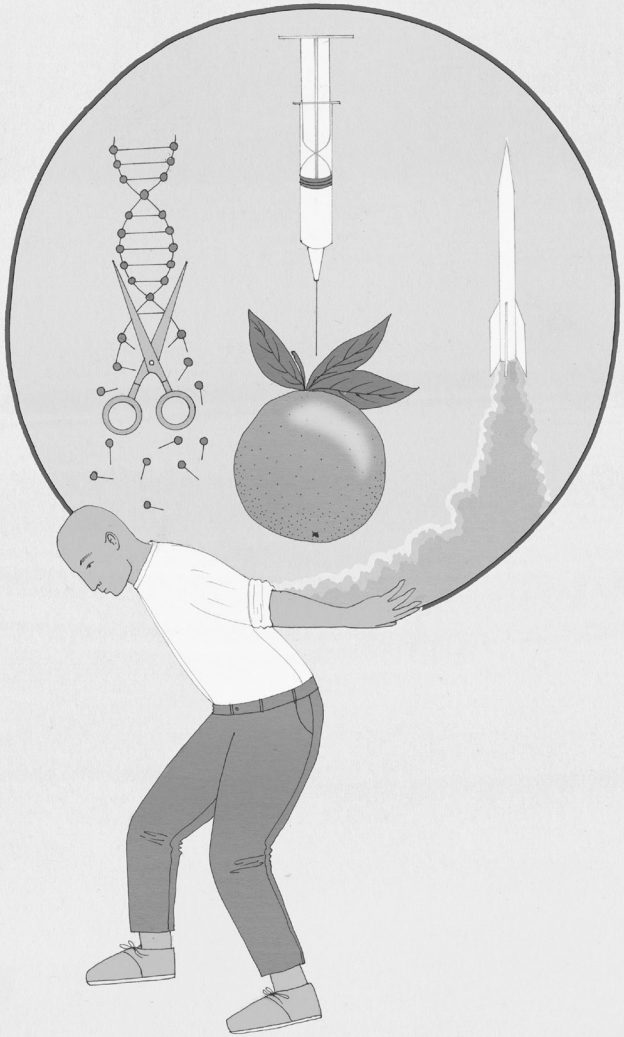
See suggested Scientific Scenarios to use with these questions.

- Does this research have an immediate benefit to society? How will it make people's lives better in the near future?
- If the research doesn't have an immediate or direct benefit, what do we gain from doing this research?
- If you had the power to develop one research project, would you choose one that directly tackles a world problem or one where we don't know yet if it will solve a problem?

Scientific Scenarios

Extinction
Scientists are researching whether it might be possible to bring back the Woolly Mammoth from extinction. If they discover that it is possible, it could help humans bring back other extinct species.

Universe
Scientists are developing new technology that will help them learn more about far away galaxies. This could help us understand more about how our universe was formed. This research may also help scientists find planets in other galaxies that have the right conditions for humans to live.



Should scientists always be responsible for how their research is used?

Performance Activity: Scientist in the Hot Seat

Select one of the Scientific Scenarios below or choose your own scenario.

Explain to the class that sometimes research is not always used for its intended purpose and can be adapted for purposes that a researcher may not agree with.

Ask one student to sit in front of the class. They are now the scientist who has been working in this area of research. They have just found out that their research has been mis-used and they are now faced with a serious ethical dilemma. Invite the rest of the class to ask the researcher questions, for example: How does this make you feel? Did you have any idea this could have happened? If you had known before, would have stopped doing your research? Do you feel responsible?

Reflect on the activity, asking the class:

- What would you do if you were the scientist in this situation? Would you continue to work on this research?
- Did hearing a scientist's perspective help you consider a different situation or change your view at all?

10 minutes

Role Play

Reflective thinking; Considering ethics; Critical thinking and reasoning

Should scientists always be responsible for how their research is used?

Science and Society Questions

See suggested Scientific Scenarios to use with these questions.

- Scientists often now make their research findings publicly available, meaning the public and other scientists can access their findings. Is this a good idea? How could it affect the way scientists work?
- As citizens, should we all think about how our work (or behaviour) can have a positive effect on the future of humanity and the planet? What might the challenges be in thinking this way?
- If you were the researcher, and you found out your research had been dangerously mis-used, how would you feel? What might you do?

Scientific Scenarios

Chemical fertilisers
You are a researcher working on a process that allows fertilisers to be made, making farming more efficient. However, after you have retired you discover that your research is being used to create explosives.

GM Crops
You are a researcher working on genetically modifying tomatoes to make them have a higher nutritional value and higher yield. Governments across the world want to grow the tomato to increase food production. They don't want to restrict its planting which means that there is a risk that it will outcompete and take over native tomato species, dramatically changing ecosystems.

Why is it important to have a broad range of people involved in science?

Performance Activity: Tell Me Something I Don't Know

Select one of the Scientific Scenarios below or choose your own topic.

Arrange your class into pairs. Assign each student in a pair to be either Person A or Person B.

Without any preparation time, ask Person A to talk for a minute, telling Person B anything and everything they know about the chosen topic. It is important they know they can say anything, fact or opinion and should speak for the whole minute without stopping. Ask Person B to listen carefully, making a note of anything that they didn't know before.

Swap the roles around in the pairs and repeat the activity with the same topic.

Reflect on the activity, asking the class:

- Did you learn anything new from what your partner said?
- Was there anything you didn't agree with?
- Did your opinions on the topic change having listened to your partner's speech?
- Do you feel you know more about the topic having listened to each other?
- Why is listening to others important when doing science?

5 minutes

Improvisation

Communicating ideas; Reflective thinking; Listening skills; Using initiative

Why is it important to have a broad range of people involved in science?

Science and Society Questions

See suggested Scientific Scenarios to use with these questions.

- What do you think would happen if all the researchers working on this scientific topic were from one country or culture?
- Could there be any negative consequences of involving a broad range of researchers in this
- scientific topic?
- Do you think scientists know best about this scientific topic? How could the research be changed based on input from non-scientists?

Scientific Scenarios

Use 'Topics' for the Performance Activity and as examples for the 'Science and Society questions', using the notes as a guide.

Topic	*Notes*
Stem Cell research	Male and female researchers may bring a different perspective to research on embryo testing.
Deforestation	Researchers from different countries may bring different perspectives on the effects of deforestation.

How to use the Performing Science cards

These cards support students to explore ethical issues relating to scientific research and its impact on society. Each of the 6 sections is themed around one main ethical question.

Each Performing Science section contains:

- An Illustration
- Instructions for a Performance Activity
- Science and Society questions

Contents

- If research poses a risk to humans or nature, should we still go ahead with it? >>
- Who should be involved in deciding which research projects get developed? >>
- Should we believe everything we read about science? >>
- Should research always provide a direct benefit to society? >>
- Should scientists always be responsible for how their research is used? >>
- Why is it important to have a broad range of people involved in science? >>

How to use the Performing Science cards

Illustrations

Each image illustrates the main ethical question framing the section. The images can be used as a standalone resource to initiate discussion or alongside the Performance Activity or Science and Society questions.

Talking about the different elements within these artworks should support visual learning to interpret and reflect on the ethical question. Here are some ideas for use:

1. Show an illustration on the board and use it as a 'focusing activity' as students arrive into your classroom.
2. Get students to share their first thoughts: Describe what is happening in the image. What different images can you see? Do you recognise any signs or symbols? What do you like or dislike about it?
3. Ask students to 'read' and unpick the illustration. What question or message do you think the image is trying to communicate?
4. Ask students to write their responses as questions, phrases or single words on post-it notes and stick them onto the image at the front of the class.
5. You may choose to follow up on the post-it note questions or simply use this activity as a warm up.

How to use the Performing Science cards

Performance Activity

The cards provide instructions for a short Performance Activity that explores the main ethical question framing the section. The activities are quick and easy to manage within a classroom setting. They involve a variety of accessible performance techniques such as role play, prop-use, self-narration, characterization. The key explains the time required, type of performance and relevant transferable skills.

Before beginning, you will need to choose a scientific topic to be the focus of the activity - we have provided some Scientific Scenarios as examples.

Icon key

Time required

Performance method

Transferrable skills developed through activity

How to use the Performing Science cards

Science and Society questions

This section proposes additional questions to support a deeper exploration of the main ethical question framing the section. You can use the questions for standalone discussion, to extend the Performance Activity or to support exploration of the illustration. Draw upon the Scientific Scenarios and examples from the curriculum to contextualize the questions.

Scientific Scenarios

The Scientific Scenarios introduce examples of current scientific research, some of which are explored further in the Meet the Scientist videos. Many of the scenarios also link to topics taught in the English, French and Spanish science curriculums, so you can use them alongside curriculum teaching.

Discussion facilitation tips:

1. Make sure all students understand the question. Support students by asking them to highlight any words they don't understand, highlight key words or explain the question in their own words.
2. Give students time to consider their answers before whole class discussion. You could ask them to write their first thoughts (e.g. write continuously for a minute) or share ideas with a partner.
3. During whole class discussion it is important to emphasise that there are many good answers and no one right answer. Encourage students to respect and listen to each speaker and build on each other's ideas.
4. End discussion by inviting students to reflect on how their views have changed since the start of discussion and what they have learnt from others.