

E.T. Can't phone Home

This activity involves:

- reading the article 'E.T. can't phone home'
- answering questions on the article and a film if available
- reading the article 'Declaration of Principles Concerning Activities Following the Detection of Extraterrestrial Intelligence'.

Introduction

Chapters 15 and 16 tell the story of humankind's vision increasing in scope from the enclosed Universe of the ancients to the boundless Universe of modern science. This activity and the activity 'We should be so lucky' begin to consider the consequences of this view. This activity can link into project work on a piece of science fiction writing. Students that show a particular interest may relish the opportunity to criticise a recent science fiction film and should be given the opportunity. Others may skip this part of the activity.

Answers to questions

3 See table:

object	Distance from Earth/m	Time taken for signal travel between Earth and object/s	Time taken for signal travel between Earth and object/years
Sun	149 600 000 000	499	0.000016
Saturn	1426 000 000 000	4750	0.00015
Centre of Galaxy	2.8×10^{20}	9.3×10^{11}	29170
Andromeda Galaxy	2.1×10^{22}	7×10^{13}	2.2 million
Moon	380 000 000	1.3	3.9×10^{-8}
Vega	2.5×10^{17}	8.3×10^7	26

References

Textbook
Chapter 16

Specification
10.6 The move away from an Earth-Centred View of the Universe

12.2a recognise that the interests and concerns of society influence the directions of scientific research and technological development, and the extent of funding for work in different areas; 12.2b recognise that a person's views and expectations (and their social interests and commitments) can influence the data they collect and their interpretation of it; 12.2c recognise that we often consider personal characteristics of scientists (such as their reputation, their seniority, and the interests of organisations they work for) when we evaluate their statements, and consider how far this is justified.

Resources needed:

Student sheet, 'Declaration of Principles Concerning Activities Following the Detection of Extraterrestrial Intelligence'. **This can be downloaded from the SETI Institute at <https://www.seti.org/> then type 'principles' in search box.**

*Directed activities
related to text*

Passive reading techniques such as copying text from the board rarely involve deciphering and comprehension of the text. There are many ways that reading text can be made into a more active process.

Making notes from a chapter can be made more active by providing particular headings to structure the notes. Even better, students can be asked to summarize ideas in the text, or present ideas in an alternative form such as a flow chart, table or mind map.

Students could be asked to devise questions they have on the text. This will help identify problem areas. As a group activity, students could swap questions, and discuss the answers. They could also attempt to answer each other's questions and hand them back for 'marking'.

Active engagement with texts is needed when students are asked to seek information for a task such as researching for a presentation, or making an information leaflet or poster.

Questions relating to a text can be provided to create a comprehension exercise. Questions can be carefully worded to discourage copying of passages from the text, and encourage re-writing or interpretation of the text. It can be useful to highlight passages which answer questions or provide information for an explanation.

- 4 a. Any well-argued answer will have merit. It does not take much imagination to realise that if an intelligent message from space was received it would be a world-changing event. This takes planning! A perhaps more interesting problem would be that once such a message was received nothing more would happen. Imagine if a distant civilisation received the attempts that twentieth century humanity made at interstellar communication. Something happened, and then nothing for a long, long time.
- b. This is difficult to give an answer to, as individual students will have their own views. This can be the basis of a discussion rather than a written response.

*This document has been downloaded from the
Science for Public Understanding website
www.scpub.org*

E.T. can't phone home

1. Read the article 'E.T. can't phone home'.
2. The article suggests that although interstellar travel is very unlikely many films have creatures moving across huge distances with apparent ease. If you have access to a video, or know a film very well, try answering these questions based on the film – they will help you make up your mind about the possibility of reality catching up with films.
 - a. What kind of space travel is used in the film? Are you given any clue how it works?
 - b. How did the aliens know that we are here before visiting us?
 - c. Does the film show how long the journey's take?
3. The fastest method of communication is by electromagnetic radiation such as radio waves. You can calculate how far an electromagnetic wave travels in a given time using the equation

$$\text{speed} = \frac{\text{distance}}{\text{Time}}$$

The speed of light is 3×10^8 m/s (300 000 000 m/s).

One year is 32 000 000 seconds

Use the equation to complete the table.

object	Distance from Earth/m	Time taken for signal to travel between Earth and object/s	Time taken for signal to travel between Earth and object/years
Sun	149 600 000 000	499	0.000016
Saturn	1426 000 000 000		0.00015
Centre of Galaxy	2.8×10^{20}	9.3×10^{11}	29170
Andromeda Galaxy	2.1×10^{22}	7×10^{13}	
Moon	380 000 000		3.9×10^{-8}
Vega	2.5×10^{17}		

- 4 Read through 'Declaration of Principles Concerning Activities Following the Detection of Extraterrestrial Intelligence'. <https://www.seti.org/> then type 'principles' in search box.
 - a. Explain why it is thought necessary to have a plan like the Declaration in the event of extra-terrestrial intelligence being detected.
 - b. State and explain whether you think young people in Britain would be excited or worried about such a discovery. You might want to think about the following areas in your answer:
 What affect might such a discovery have on the major religions?
 Would the discovery suggest a danger?
 Could we communicate back to the senders of the message?

E.T can't phone home

At the end of the twentieth century a rash of Hollywood films were made which featured interstellar space travel and interstellar communication. These ranged from 'Alien', through the 'Star Wars' films to 'Men in Black'. Sometimes humans travelled from Earth to other worlds (as in all those Star Trek movies) sometimes, as in 'E.T.' and 'Close Encounters', the creatures came to Earth from Space. A feature of many of these films is the ease with which people and weirdly-formed aliens managed to communicate with each other. There is no delay in sending and receiving messages across vast distances of interstellar space. Is this possible?

Can we conceive any method for getting creatures from other star-systems to Earth? Many people believe in the possibility that extra-terrestrials are somehow visiting Earth but few can suggest any means for them to get here. Sceptics, who do not accept that bug-eyed monsters are visiting Earth, often argue that interstellar travel would simply take too long. Any journey across interstellar space would last generations of human lives. A common response to this argument is that we don't know the level of technology of advanced life forms. Perhaps there are methods of travel that the relatively backward life form inhabiting Earth (that's us) have yet to discover.

This is where we meet a real problem in the shape of the Special Theory of Relativity of Albert Einstein. This theory, published in 1905, states that nothing can travel faster than the speed of light. As light travels at three hundred million million metres per second (300 000 000 m/s) this doesn't make much difference to everyday life. But it does cause problems to space travellers and interstellar communication. The nearest star, Proxima Centauri, is a little over four light years away. It takes a message sent by any form of electromagnetic radiation four years to reach Earth from Proxima Centauri. This means that if we sent the message 'Is there anybody there?' we would have to wait about eight years for any hope of reply. As Einstein's theory has had many, many experimental confirmations physicists accept Einstein's ideas and assume that nothing can go faster than light.

This makes two-way communication across the galaxy a practical impossibility in the human time frame. Humans simply don't live long enough to hang around waiting for a reply from a distant star. The Earth lies towards the edge of a spiral galaxy. The galaxy is about 100 000 light years across. To try and get a feel for scale, if the galaxy is the size of continental Europe the solar system would be about the size of a doughnut. It takes electromagnetic radiation one hundred thousand years to get from one side of the galaxy to the other. If technologically advanced societies are trying to get in contact it will take an awfully long time for the conversation to take place. To put this into context, remember that the entire history of literate humanity only extends a few thousand years.

In the film 'ET' the cute, baby-faced alien 'phones home'. He could certainly beam a message to a nearby spacecraft, but if he was truly contacting his home planet around a distant star he would have to wait a very long time to get rescued, and the film audience would probably get a little bored in the meantime.

Many people still think it is important to try and send out a message to space to let anyone who might be listening know that we are here – or at least were here when we sent the message. In fact, we have been sending electromagnetic signals out into space for nearly a century. Whenever a radio or television programme is broadcast a fraction of the signal escapes into space and spreads away from Earth at the speed of light. This means that, for example, news of the declaration of the end of hostilities in Europe in 1945 has now reached out to a radius of about sixty light years. If there is a technological society on a planet orbiting the star Arcturus they will begin enjoying the music of the Beatles in a few years time and find that humankind has reached the moon before the end of the decade.

The star Sirius is a mere nine light years distant. If intelligent beings live on a planet around Sirius they will have had the opportunity to enjoy many Eurovision Song Contest finals, Children in Need and the first few years of EastEnders. It makes you wonder what they might think of us.

Humanity has recently sent more deliberate messages out into the space. Frank Drake at the Greenbank National Radio Astronomy Observatory made the first real attempt. Under his guidance signals were sent to stars about ten light years from Earth in 1960. We are still waiting a response.

Since Drake's pioneering work the SETI (search for extraterrestrial intelligence) project has sent many messages out, and listened with all the technology at their disposal for any possible signal from space. So far we have heard nothing. This has caused surprise to some scientists who are looking for explanations of our apparent loneliness. Perhaps a more interesting question for the public is 'what would we do if we did make contact?'