

# Year 9/10 Energy and the Universe

## **NESA Outcomes**

PW1b - identify situations where waves transfer energy

PW1c - describe, using the wave model, the features of waves including wavelength, frequency, and speed

PW1d - explain, using the particle model, the transmission of sound in different mediums

PW1e - relate the properties of different types of radiation in the electromagnetic spectrum to their uses in everyday life, including communications technology

PW1f - describe the occurrence and some applications of absorption, reflection and refraction in everyday situations

**Extension:** relate scattering and dispersion of light to everyday occurrences

ES1a - outline some of the major features contained in the universe, including galaxies, stars, solar systems and nebulae

**Extension:** relate colours of stars to their age, size and distance from the Earth

**Extension:** describe some recent contributions made by Australian scientists in the exploration and study of the universe

ES1b - describe, using examples, some technological developments that have advanced scientific understanding about the universe

ES1c - use appropriate scales to describe differences in sizes of and distances between structures making up the universe

ES1d - identify that all objects exert a force of gravity on all other objects in the universe

ES1e - use scientific evidence to outline how the Big Bang theory can be used to explain the origin of the universe and its age

ES1f - outline how scientific thinking about the origin of the universe is refined over time through a process of review by the scientific community

**Extension:** describe evidence used to support estimates of time in the universe

**Extension:** outline examples where advances in science and emerging science and technologies significantly affect people's lives, including generating new career opportunities in areas such as **astrophysics**, geophysics, **space science** and vulcanology

# Year 9/10 Energy and the Universe

## *Student Learning activities*

- 1) What is a wave? Explain how amplitude and frequency are used to define and measure a wave.
- 2) Explain using a diagram and some text (videos are also allowed), how each of the following waves are identified and described.
  - a. Sound waves
  - b. Ocean /beach waves (Water waves)
  - c. Light waves
  - d. The 3 types of earthquake waves
- 3) What is the Doppler effect? How can you observe the doppler effect in sound waves? Describe an example or attach/submit a video/sound file that demonstrates the doppler effect.
- 4) Explain how the speed of a wave can be calculated. We need a mathematical equation to answer this question.
- 5) Look up the speed of sound in air, water, and steel, then use this information to come up with your theory of how the density of a substance affects the speed of sound. Remember that Air is the least dense and Steel is the densest.
- 6) Investigate how the speed of light is affected by the density of the materials it travels through compare glass with air.
- 7) Define the following terms: Absorption, reflection and refraction Use both a written definition and a diagram to explain them.
- 8) Describe one real world example for each of absorption, reflection, and refraction.
- 9) **Extension:** detail real-world examples of scattering and dispersion.
- 10) Define and describe the terms Universe, Galaxies, stars, solar systems and nebulae.
- 11) Make up a table and detail some of the differences between Galaxies, stars, solar systems and nebulae, a third column with pictures of each could be helpful.
- 12) **Extension:** What does the colour of a star tell us about its age, its size and how far away it is from us?
- 13) **Extension:** Describe some recent contributions made by Australian scientists in the exploration and study of the universe.
- 14) Explain how the technology in the James Webb telescope has advanced / changed when compared to the Hubble telescope? What have these changes allowed Scientists to achieve?
- 15) Define an Astronomical unit (AU). How far does light travel in 1 second, how far does light travel in one year, that is what is a light year?
- 16) How far is the horse head nebula from Earth? If we could travel at the speed of light how long would it take to get there?
- 17) How far away is the most distant known star or galaxy? How long did it take for that light to get to us? Do you think that star or galaxy still exists?
- 18) How far is the nearest star other than our sun from us, what is it called, can we get there with our current technology?
- 19) Define and describe newton's law of gravity. Also, detail what it tells us about the interactions of the moon and the Earth, two bodies in space.
- 20) What is the big bang theory, what evidence do we have today that it took place, also how long ago is it thought to have happened? As in how old is our universe?
- 21) What are the three main theories about the formation, development, and evolution of our universe?
- 22) Prepare a table that summarises some facts about the planets in our solar system, it should include things like its name, distance from the sun, number of moons, diameter of the planet, length of time for one orbit around the sun (a year), tilt, time of one spin on its axis (a day).
- 23) **Extension:** Describe evidence used to support estimates of time in the universe.
- 24) **Extension:** Outline examples where advances in science and emerging science and technologies significantly affect people's lives, including generating new career opportunities in areas such as **astrophysics**, geophysics, **space science** and vulcanology.