

PAG 11

GPAC links	Evidence	Done
5a	Uses appropriate software and/or tools to process data, carry out research and report findings.	Research done
5b	Sources of information are cited demonstrating that research has taken place, supporting planning and conclusions.	Report with citations

Objective

- To investigate our current understanding of dark matter and dark energy

Safety

- No safety issues

Procedure

Current estimates, using our scientific knowledge, suggest that approximately 68% of the Universe is dark energy and 27% is dark matter. This leaves only 5% of the Universe being made up of normal matter.

Evidence for dark matter can be drawn from the work of Vera Rubin. During the 1970s, she used data from the rotation of galaxies to hypothesise that observations suggest there is more mass than we can detect. Since then, observations of gravitational lensing have also indicated the existence of dark matter.

The evidence for dark energy is less clear. Scientists know that it affects the expansion of the Universe, but little else is known for certain.

- 1 Using books, journals and online sources, investigate our current understanding of dark matter and dark energy, as well as the evidence that supports this understanding. Record your notes and sources of information in the space provided.
- 2 Write a report of approximately 2500 words to explain your findings, taking a diagram to be the equivalent of 250 words, and including no more than four of these. Ensure that all references are correctly cited. Use a separate piece of paper for your report.
- 3 Attach your references list to your report. This does not count towards your 2500 words.

Learning tip

Always follow a recognised format for citing references from scientific journals. Do not include the web address alone, even if sources are available online.

Questions to consider in your report

- 1 What did Vera Rubin observe?
- 2 Why did her data appear to need more mass than we could observe?
- 3 What theories regarding the expansion of the Universe have scientists used over time?
- 4 Why do scientists need dark energy to support the currently accepted theory?
- 5 What is gravitational lensing?
- 6 What is a WIMP?