

SECTION B*Answer all questions.*

The questions refer to the case study.
Direct quotes from the original passage will not be awarded marks.

6. (a) Describe very briefly the evidence Edwin Hubble gathered and how it supports the Big Bang Theory (paragraphs 3 and 10). (Do not include a diagram in your answer.) [3]

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- (b) What does the author mean when it is stated that '*... particles were at relativistic speeds*'? (paragraph 5). [1]

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- (c) Explain briefly why '*baryogenesis, a reaction that we know little about*' is required to explain the current content of the universe (paragraph 5). [2]

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- (d) Explain why the production of electron-positron pairs stops at a later time than proton-antiproton pairs (paragraph 6). [2]

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- (e) Explain briefly what the term '*Big Bang nucleosynthesis*' means and what enabled this process to take place (paragraph 7). [2]

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- (f) In your own words, explain briefly why the universe became transparent after 380 000 years (paragraph 8). [3]

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- (g) Show clearly how **equation 3** is derived (paragraphs 10-12). [3]

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- (h) Use **equation 3** to confirm that the critical density of the universe corresponds to around 5 hydrogen atoms per cubic metre (paragraphs 10-12). [2]

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- (i) Use **figure 2** to confirm that the mean temperature of the universe is approximately 2.725 K. [2]

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