**The universe (answers)**

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| Instructions to students  • You have 50 minutes to complete the test.  • Please answer all questions in the spaces provided.  • There is to be no talking during the test. | Marks  Section I: Multiple-choice questions: 10 marks  Section II: Short-answer questions: 35 marks  Section III: Extended-response questions: 5 marks  Total: 50 marks |

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| Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Class: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Score: /50  Grade: % |
| Comments: | |

Section I: Multiple-choice questions

For each question, circle the correct answer.

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| 1 Our Sun is part of the galaxy known as: | | CT0601_07059-rm |
| A | the milky way. |
| B | Orion. |
| C | Proxima Centauri. |
| D | Andromeda. |
| 2 The more negative the absolute magnitude of a star, the: | | |
| A | cooler it is. | |
| B | brighter it is. | |
| C | hotter it is. | |
| D | dimmer it is. | |
| 3 When a star explodes and releases bright light and energy, it is called a: | | |
| A | main separation. | |
| B | black hole. | |
| C | supernova. | |
| D | quasar. | |

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| 4 If the radius of the Earth's orbit is known, the distance to star A can be calculated by measuring X. | |
| CT0602_07059-r  X is the: | |
| A | apparent magnitude angle. |
| B | absolute magnitude scale. |
| C | radius of the Earth’s orbit. |
| D | parallax angle. |
| 5 The conclusion from Hubble’s Law is that: | |
| A | we are at the centre of the Universe. |
| B | the more distant galaxies are travelling the fastest. |
| C | everything is moving away from Earth. |
| D | the further a galaxy is away from Earth, the slower its speed. |
| 6 A star is 6.62 × 1014 km away from Earth. Approximately how many light years distance is this if one light year is 9.46 × 1012 km? | |
| A | 7000 |
| B | 70 |
| C | 7 |
| D | 700 |

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| 7 Cosmic microwave background (CMB) radiation is evidence for the: | |
| A | Cyclic theory of the Universe. |
| B | Big Crunch theory of the Universe. |
| C | Big Bang theory of the Universe. |
| D | Steady State theory of the Universe. |
| 8 The change in wavelength of sound waves emitted from a moving sound source is known as: | |
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| A | the Doppler effect. |
| B | red shift. |
| C | Einstein’s equation. |
| D | Hubble’s Law. |
| 9 The colour of a star depends on: | |
| A | its age |
| B | its size |
| C | how far away it is |
| D | its surface temperature |

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| 10 On the Hertzsprung–Russell diagram the diagonal line from top left to bottom right represents the: | |
| CT0604_07059-r | |
| A | main sequence. |
| B | red giants. |
| C | star sequence. |
| D | main separation. |

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|  | Section I total marks:  /10 marks |

Section II: Short-answer questions

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| 11 The weightlessness astronauts experience in space can weaken bones and muscles so much that they are unable to stand up when they return to Earth. How is this problem now managed? | |
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| They exercise before and during space missions. | |
|  | /1 mark |
| 12 Determine if each of the following in the list below is a constellation, star or galaxy.  • Sun  • Milky Way  • Orion  • Proxima Centauri | |
| Constellation: Orion  Star: Sun, Proxima Centauri  Galaxy: Milky Way | |
|  | /4 marks |
| 13 What are galaxies and how do we classify them? | |
| CT0606_07059-rf | |
| Galaxies are groups of billions of stars held together by gravity (1 mark). They are classified according to their shape (1 mark), which is spiral, irregular or elliptical. | |
|  | /3 marks |
| 14 Proxima Centauri is located outside our solar system at 4.2 light years away. Explain what this distance means. | |
| This means light takes 4.2 years to reach Earth from Proxima Centauri. We would see anything, such as an explosion, 4.2 years after it has occurred. | |
|  | /2 marks |
| 15 Two stars in the night sky appear to be the same brightness. Are they the same distance from Earth? Explain your answer. | |
| No, not necessarily. Explanations will vary. One possible answer is that one of the stars might be a dim star that is very close to the Earth while the other is a very bright star that is further away. | |
|  | /2 marks |
| 16 A racing car makes a ‘yeee … owww’ sound as it speeds towards and then past an observer.  a Choose the correct terms in the following statement, relating the sound to the blue and red shift of the Doppler effect and to the movement of galaxies towards and away from us.   The ‘yeee’ is a higher/lower frequency, which corresponds to a blue/red shift in light, which indicates movement towards/away from us. | |
| a The ‘yeee’ is a **higher** frequency, which corresponds to a **blue** shift in light, which indicates movement **towards** from us (1 mark for each correct). | |
| b The pitch of the racing car changes as the car drives past the observer. Is this change noticeable by the driver of the car? Explain your answer. | |
| b No (1 mark). It is only an apparent change OR it is only noticeable by a stationary observer (1 mark). | |
|  | /5 marks |

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| 17 Describe how Indigenous Australians used the Milky Way to determine times of the year for hunting emus and collecting eggs. | |
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| Within the Milky Way there is a dark patch that looks like an emu (1 mark). At certain times of the year the emu looks like it is running; this indicates a time to hunt emu (1 mark). At other times the emu looks like it is sitting; this indicates a time to collect emu eggs. (1 mark) | |
|  | /3 marks |
| 18 The apparent magnitude of our Sun is –27 while its absolute magnitude is +4.8. What do these two numbers tell us about our Sun? | |
| The –27 tells us the Sun is very bright when viewed from Earth. The +4.8 tells us the Sun is not a very bright star when compared to all other stars. | |
|  | /2 marks |

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| 19 Label the *x*-axis on the Hertzsprung–Russell diagram below. Which of the four bands (A, B, C or D) represents the white dwarfs? | |
| CT0608_07059  Band B represents white dwarfs | |
|  | /2 marks |
| 20 Arrange the following stages in the life cycle of a star in the correct order from earliest to latest:  red giant, white dwarf, main sequence star, black dwarf | |
| main sequence star, red giant, white dwarf, black dwarf | |
|  | /4 marks |
| 21 Draw a line matching each scientist to the contributions they made to our understanding of the universe. | |
|  | |
|  | /3 marks |
| 22 Why can’t the distance to distant stars (beyond 100 light years) be measured using stellar parallax? | |
| The more distant a star, the less parallax it shows, and the more difficult to measure and determine its distance | |
|  | /2 marks |
| 23 Describe how cosmic microwave background radiation provides evidence that supports the Big Bang theory. | |
| The Big Bang theory relied on the idea of the existence of some sort of radiation. It was hypothesised that the large amounts of heat released would still exist in a much cooler form. This leftover energy existed as background radiation or CMR. | |
|  | /2 marks |
|  | Section II total marks:  /35 marks |

Section III: Extended-response questions

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| 24 Outline how nuclear fusion is able to occur within a nebula, resulting in the birth of a star. | |
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| Nebulae are large clouds of hydrogen gas (1 mark). The nebulae are attracted to each other by gravity (1 mark). The hydrogen atoms in the centre of the cloud are under a great deal of pressure, causing the centre of each nebula to heat up (1 mark). Eventually there is enough heat and pressure to fuse two hydrogen atoms together, forming helium (1 mark). This nuclear fusion releases large amounts of energy in the form of heat and light, resulting in the birth of a star (1 mark). | |
|  | /5 marks |
|  | Section III total marks:  /5 marks |