M11/4/ASTRO/SP1/ENG/XX

International Baccalaureate®
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Bachillerato Internacional

Astronomy
STANDARD LEVEL
Paper 1

Friday 29 April 2011 (morning)

45 minutes

Candidate session number

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INSTRUCTIONS TO CANDIDATES

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- There are four sections – answer ALL questions in all four sections.
- ALL answers are to be written on the exam paper.

ADDITIONAL INSTRUCTIONS

- Calculators are allowed.
- A 1-page *Information Sheet* is provided for this examination.

Marking Grid	
Section	**Marks**
1	
2	
3	
4	
Total / 30	

You may find the following information useful

1 AU = 1.496×10^{11} m

1 parsec = 206265 AU = 3.09×10^{16} m = 3.26 light years

1 light year = 0.307 parsecs = 9.47×10^{15} m

$c = 3 \times 10^{8}$ m s^{-1}

$G = 6.67 \times 10^{-11}$ N m^2 kg^{-2}

$\sigma = 5.67 \times 10^{-8}$ W m^{-2} K^{-4}

$L_{\odot} \approx 3.84 \times 10^{26}$ W

$T_{\odot} \approx 5770$ K

$M_{\odot} \approx 1.99 \times 10^{30}$ kg

$R_{\odot} \approx 6.96 \times 10^{8}$ m

$H_o \approx 72$ km s^{-1} Mpc^{-1}

$$z = \frac{H_o}{c} d$$

$$F = \frac{L}{4\pi d^2}$$

$c = f\lambda$

$$\lambda_{max} = \frac{2.90 \times 10^{-3}}{T}$$

$$PE = -\frac{GMm}{r}$$

$E = mc^2$

$$d = \frac{1}{\phi}$$

$$\frac{b_1}{b_2} = 2.5^{(m_2 - m_1)}$$

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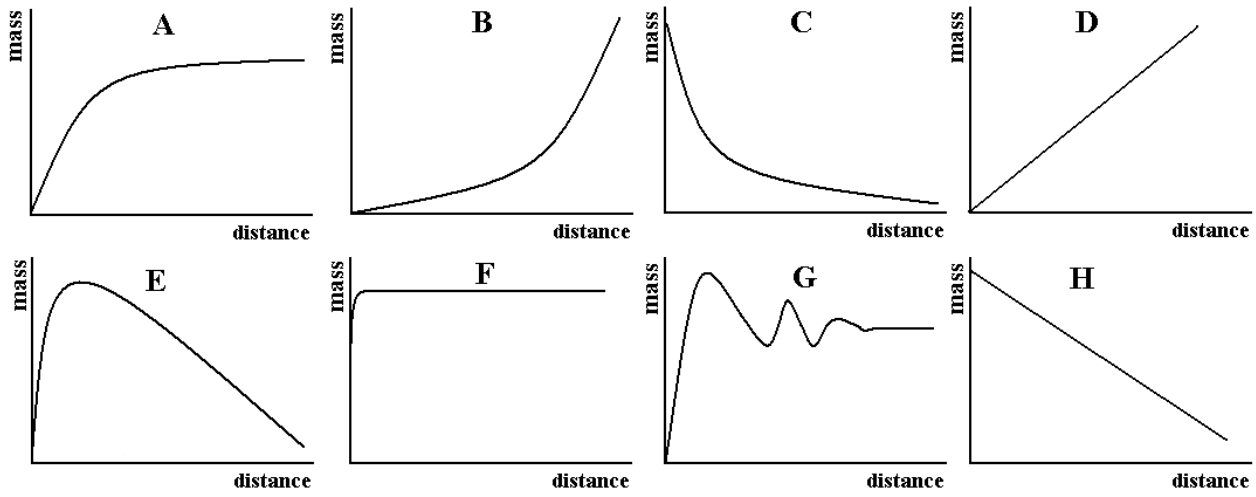
Section 1 The Stars (8 marks)

1. The mass-distribution curve indicates the mass contained with a distance, from the centre of mass of the system.
Which of the following graphs best describes the mass-distribution curve for the solar system?



Answer : ……

[1 mark]

2. The nuclear fusion occurring in the core of the Sun can be summarised with the equation below.

$$4\ {}^{1}_{1}H \longrightarrow {}^{4}_{2}He + 2e^{+} + 2\nu_e + 2\ X$$

What is X?

……

[1 mark]

3. Given that the stellar parallax of the double star Albireo is 0.009 arcsec, how far away is this star from the Sun (give your answer in Astronomical Units)? You should show your working.

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[2 marks]

4. Explain why there is a maximum possible value for the mass of a star.

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[2 marks]

5. When the Sun eventually dies, what type of star will it become and what will stop it collapsing against the contracting force of gravity?

Type of star : ……

Gravity balanced by : ……

[2 marks]

Section 2 The Planets (8 marks)

6. What are the three main constituents of the atmosphere of the planet Venus? They do not need to be given in order.

Constituent 1 : ……

Constituent 2 : ……

Constituent 3 : ……

[3 marks]

7. Briefly discuss two pieces of evidence that indicate that the Earth is a differentiated planet.

Evidence 1 : ……

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Evidence 2 : ……

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[2 marks]

8. Why is a wavelength of 21cm used to look for the presence of life in the universe?

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[2 marks]

9. Give one piece of evidence which suggests that the Moon was once part of the Earth.

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[1 mark]

Section 3 Galaxies (7 marks)

10. The following images show two different types of galaxy. Using the Hubble classification for naming galaxies, state what type of galaxy is shown.

Name : NGC 1073 M99

Type of galaxy : …… ……

[2 marks]

11. Describe the motion of the Sun in the Milky Way

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[2 marks]

12. Give one constituent of Cosmic rays.

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[1 mark]

13. Briefly indicate what is meant by the term *Active Galaxy*.

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[2 marks]

Section 4 Cosmology (7 marks)

14. Explain briefly what is meant by the term *Olber's paradox*.

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[2 marks]

15. State TWO possible solutions to Olber's paradox.

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[2 marks]

16. Which one the following statements is correct if the geometry of spacetime is flat ?

A : Parallel lines diverge.
B : Parallel lines do not intersect.
C : The circumference of a circle > $2\pi r$.
D : The circumference of a circle < $2\pi r$.
E : Straight lines come back to the same point.
F : The internal angles of a triangle > 180°.

[1 mark]

17. The value of Hubble's constant can be given as 2.3×10^{-18} s^{-1}. Use this value to estimate the age of the universe in years.

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[2 marks]

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END OF EXAMINATION PAPER