



MYAO

MALAYSIAN ASTRONOMY OLYMPIAD

2019

QUESTION BOOKLET

INSTRUCTIONS

Do not open this booklet until you are instructed by the invigilator.

Time allocated: **2 hours 30 minutes**

Languages: **English & Bahasa Melayu**

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This Question Booklet contains:

- 30 objective questions.
- 1 subjective question.
- **Students are required to answer all questions.**

.....
Answer the objective questions in the provided MCQ Answer Sheet.

- Fill in and shade your Student ID at the top.
- Write your name in the "Name" field and your category in the "Subject" field.
- Use **2B PENCIL** to shade your Student ID and answers.
- Choose **ONLY 1(ONE)** answer for each question.

.....
Answer the subjective question in the provided MyAO Answer Sheet.

- Only **2B PENCIL, PEN, CORRECTION TAPE OR LIQUID PAPER** and **ERASER** are needed. Scratch papers are provided at the end of the Answer Sheet.
- Write your name & Student ID and tick (✓) your category on the front page.
- Do not write anything in the rightmost column ("Examiner's Use Only").
- You may use English or Bahasa Melayu.
- Make sure your Student ID is written on all pages including extra sheets.
- Students are required to provide an explanation for each written answer. Lack of explanation will lead to less marks.

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It is forbidden to discuss or publish the questions online until one month after the contest date (20th November 2018).

GOOD LUCK!

List of Formula & Constant

Speed of light in vacuum, c	$299\,792\,458\text{ ms}^{-1}$
Constant of gravitation, G	$6.674 \times 10^{-11}\text{ N m}^{-2}\text{ kg}^{-2}$
Solar Constant (at Earth), A	$1\,367\text{ W m}^{-2}$
Mean value, Hubble parameter	68
Diapason of values, H_0	$50 - 100\text{ km s}^{-1}\text{ M pc}^{-1}$
Plank constant, h	$6.626 \times 10^{-34}\text{ J s}$
Charge of electron, e	$1.602 \times 10^{-19}\text{ C}$
Mass of electron, m_e	$9.109 \times 10^{-31}\text{ kg}$
Proton-to-electron mass ratio	1836.15
Faraday constant, F	$96\,485\text{ C mol}^{-1}$
Magnetic constant, μ_0	$1.257 \times 10^{-6}\text{ H m}^{-1}$
Universal gas constant, R	$8.314\text{ J mol}^{-1}\text{ K}^{-1}$
Boltzmann constant, k	$1.381 \times 10^{-23}\text{ J K}^{-1}$
Stefan-Boltzmann constant, σ	$5.67 \times 10^{-8}\text{ W m}^{-2}\text{ K}^{-4}$
Wien's displacement constant, b	0.002897 mK
Laboratory wavelength of H_α	6562.81 \AA
Tropical year length, T	365.242199 days
Sidereal year length, T	365.25636 days
Anomalistic year length, T	365.259636 days
Nodal period of lunar orbit	-18.6 years
Standard atmosphere	$101\,325\text{ Pa}$
Visible light extinction by the terrestrial atmosphere in zenith (minimum)	$19\%, 0.23\text{ m}$
Height of homogeneous atmosphere	7991 m
Refractive index of water at 20°C , n	1.334
Moment of inertia of a solid ball	$I = \frac{2}{5}MR^2$
Moment of inertia of sphere	$I = \frac{2}{3}MR^2$
Volume of a ball	$V = \frac{4}{3}\pi R^3$
Area of sphere	$A = 4\pi R^2$
π	3.14159265
e	2.71828183
Golden ratio, φ	1.61803399
Radius of Sun	$695\,500\text{ km}$
Distance from Earth to Sun	149.6 million km
Average altitude of ISS orbits the Earth	400 km

Senarai Formula & Pemalar

Kelajuan cahaya dalam vakum, c	$299\,792\,458\text{ ms}^{-1}$
Pemalar graviti, G	$6.674 \times 10^{-11}\text{ N m}^{-2}\text{ kg}^{-2}$
Pemalar solar (di Bumi), A	$1\,367\text{ W m}^{-2}$
Nilai min, parameter Hubble	68
Nilai Diapason, H_0	$50 - 100\text{ km s}^{-1}\text{ M pc}^{-1}$
Pemalar Plank, h	$6.626 \times 10^{-34}\text{ J s}$
Cas elektron, e	$1.602 \times 10^{-19}\text{ C}$
Jisim elektron, m_e	$9.109 \times 10^{-31}\text{ kg}$
Nisbah jisim proton kepada elektron	1836.15
Pemalar Faraday, F	$96\,485\text{ C mol}^{-1}$
Pemalar Magnetik, μ_0	$1.257 \times 10^{-6}\text{ H m}^{-1}$
Pemalar gas universal, R	$8.314\text{ J mol}^{-1}\text{ K}^{-1}$
Pemalar Boltzmann, k	$1.381 \times 10^{-23}\text{ J K}^{-1}$
Pemalar Stefan-Boltzmann, σ	$5.67 \times 10^{-8}\text{ W m}^{-2}\text{ K}^{-4}$
Pemalar sesaran Wien, b	0.002897 mK
Panjang gelombang makmal bagi H_α	6562.81 \AA
Panjang tahun Tropika, T	365.242199 hari
Panjang tahun Sidereal, T	365.25636 hari
Panjang tahun Anomali, T	365.259636 hari
Tempoh lunar orbit bulan	-18.6 tahun
Atmosfera piawai	$101\,325\text{ Pa}$
Kepupusan cahaya yang dapat dilihat oleh atmosfera terestrial di zenith (minimum)	$19\%, 0.23\text{ m}$
Ketinggian atmosfera homogen	7991 m
Indeks pembiasan air pada 20°C , n	1.334
Momen inersia bagi bebola pepejal	$I = \frac{2}{5}MR^2$
Momen inersia bagi sfera	$I = \frac{2}{3}MR^2$
Isipadu bola	$V = \frac{4}{3}\pi R^3$
Luas sfera	$A = 4\pi R^2$
π	3.14159265
e	2.71828183
Nisbah keemasan, φ	1.61803399
Jejari Matahari	$695\,500\text{ km}$
Jarak dari Bulan ke Matahari	149.6 juta km
Purata altitud bagi ISS mengorbit Bumi	400 km

OBJECTIVE QUESTION

SOALAN OBJEKTIF

1. Find the magnitude for the sum of the vectors below.

Cari magnitud bagi hasil tambah vektor di bawah.

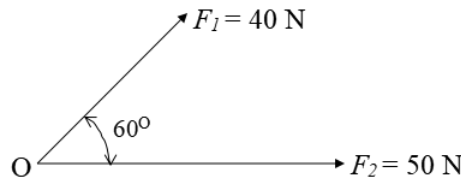
$$\vec{p} = 4\hat{i} - 3\hat{j}$$

$$\vec{a} = -2\hat{i} + 5\hat{j}$$

- (A) $2\sqrt{2}$ (B) 10.38 (C) $2\hat{i} + 2\hat{j}$ (D) $-2\hat{i} - 2\hat{j}$

2. Two forces were exerted on point O as shown below. What is another force required to put the system in an equilibrium state?

Dua daya dikenakan pada titik O seperti di bawah. Apakah daya lain yang diperlukan supaya sistem itu dalam keadaan seimbang?



- (A) 90 N at 150° clockwise from F_2 / 90 N pada 150° mengikut arah jam dari F_2
 (B) 90 N at 30° counter-clockwise from F_2 / 90 N pada 30° mengikut arah lawan jam dari F_2
 (C) 87 N at 157° clockwise from F_2 / 87 N pada 157° mengikut arah jam dari F_2
 (D) 87 N at 23° counter-clockwise from F_2 / 87 N pada 23° mengikut arah lawan jam dari F_2

3. Determine where, if exist, the function $f(x) = x^3 + 9x^2 - 48x + 2$ does not change.

Tentukan di mana, jika wujud, fungsi $f(x) = x^3 + 9x^2 - 48x + 2$ tidak berubah.

- (A) $x = 8, 2$ (B) $x = 8, -2$ (C) $x = -8, 2$ (D) Nowhere / Tiada

4. Find the first derivative of:

Cari terbitan pertama bagi:

$$f(t) = \frac{t^5 - 5t^3 + 2t}{t^3}$$

- (A) $f'(t) = 2t - 4t^3$ (B) $f'(t) = 2t - 4t^{-3}$
 (C) $f'(t) = 2t + 4t^{-3}$ (D) $f'(t) = 2t + 4t^3$

5. Solve the equation:

Selesaikan persamaan ini:

$$9 \log_4 x + 18 = 0$$

- (A) $x = 8$ (B) $x = \frac{1}{8}$ (C) $x = 16$ (D) $x = \frac{1}{16}$

6. Solve the equation:

Selesaikan persamaan ini: $(x - 3)(x + 2) = (x - 2)(x - 1)$

- (A) $x = 1$ (B) $x = 2$ (C) $x = 3$ (D) $x = 4$

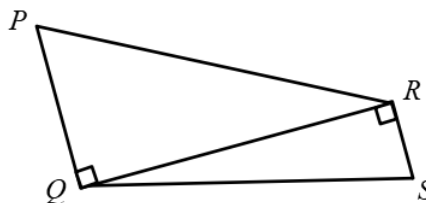
7. Simplify the expression:

Permudahkan ungkapan ini: $\frac{(2x^{\frac{1}{2}})^3}{4x^2}$

- (A) $2x^3$ (B) 512 (C) $\frac{8}{5\sqrt{x}}$ (D) $\frac{8}{4\sqrt{x}}$

8. In the figure below, if $PQ = 30$ cm, $RS = 10$ cm and $\angle RQS = 13^\circ$, find the length of PR , in cm.

Dalam rajah di bawah, jika $PQ = 30$ cm, $RS = 10$ cm dan $\angle RQS = 13^\circ$, tentukan panjang PR , dalam cm.



- (A) 53.63 (B) 52.69 (C) 31.71 (D) 31.24

9. From the top of a 200 metre-high building, the angle of depression to the bottom of a second building is 20° . From the same point, the angle of elevation to the top of the second building is 10° . Calculate the height of the second building, in m.

Dari bahagian atas bangunan berketinggian 200 meter, sudut tunduk ke bahagian bawah bangunan kedua ialah 20° . Dari kedudukan yang sama, sudut dongakan ke bahagian atas bangunan kedua ialah 10° . Kira ketinggian bangunan kedua, dalam m.

- (A) 400 (B) 275 (C) 297 (D) 213

10. Daim is looking at himself through a mirror hanging on the wall directly in front of him. What is the minimum length (measured from the top to the bottom) of the mirror, in cm, so that Daim can see his whole body, if Daim is 180 cm in height?

Daim melihat dirinya melalui cermin yang tergantung pada dinding di hadapannya. Apakah panjang minimum (diukur dari atas ke bahagian bawah) cermin, dalam cm, supaya Daim dapat melihat seluruh tubuhnya, jika ketinggian Daim adalah 180 cm?

- (A) 180 (B) 181 (C) 90 (D) 60

11. What is the wavelength of a light wave with frequency of 5×10^{14} Hz?

Berapakah jarak gelombang bagi gelombang cahaya dengan frekuensi 5×10^{14} Hz?

- (A) $59.96 \mu\text{m}$ (B) 1.499×10^{23} m (C) 1.672×10^6 m (D) $5.996 \times 10^{-7} \mu\text{m}$

12. The speed of light in a certain material is 40% of its speed in vacuum. What is the refractive index of this material?

Kelajuan cahaya dalam bahan tertentu adalah 40% dari kelajuannya dalam vakum. Apakah indeks biasan bahan ini?

- (A) 1.4 (B) 0.4 (C) 0.6 (D) 2.0

13. What is the magnification of a telescope with 1 500 mm focal length objective lens, equipped with a 25 mm focal length eyepiece and a 2X Barlow lens?

Apakah pembesaran teleskop dengan lensa objektif yang mempunyai jarak fokus 1 500 mm dilengkapi dengan kanta mata yang mempunyai jarak fokus 25 mm dan 2X kanta Barlow?

- (A) 375 times / 375 kali ganda (B) 30 times / 30 kali ganda
(C) 120 times / 120 kali ganda (D) 75 000 times / 75 000 kali ganda

14. How many times bigger is the collecting area of a 36-inch aperture telescope compared to a 9-inch aperture telescope?

Berapa kali ganda lebih besar kawasan pengumpulan teleskop apertur 36-inci berbanding dengan teleskop apertur 9-inci?

- (A) 4 times / 4 kali ganda (B) $\frac{1}{4}$ times / $\frac{1}{4}$ kali ganda
(C) 16 times / 16 kali ganda (D) $\frac{1}{16}$ times / $\frac{1}{16}$ kali ganda

15. Hipparchus found that the celestial longitudes increases about 50'' in a year. This phenomenon is later known as the precession of the Earth's equinox. Based on Hipparchus measurement, calculate the duration of the Earth's equinox precession, in year(s).

Hipparchus mendapati bahawa longitud samawi meningkat sebanyak 50'' dalam setahun. Fenomena ini kemudiannya dikenali sebagai liukan ekuinoks bumi. Berdasarkan pengukuran Hipparchus, hitung tempoh liukan ekuinoks Bumi, dalam tahun.

- (A) 1 (B) 25 740 (C) 25 920 (D) 7.2

16. Estimate the local solar time in Segamat, Johor (2.5035° N, 102.8208° E, UTC = +8h) if the clock shows 12.00 p.m., 21 June 2019.

Anggarkan masa suria tempatan di Segamat, Johor (2.5035° U, 102.8208° T, UTC = +8h) jika jam menunjukkan pukul 12.00 tengah hari, 21 Jun 2019.

- (A) 12.00 p.m., 21 June/ Jun 2019 (B) 11.48 a.m., 21 June/ Jun 2019
(C) 10.48 a.m., 21 June/ Jun 2019 (D) 1.12 p.m., 21 June/ Jun 2019

17. What type of black hole that was imaged by the Event Horizon Telescope (EHT) in the centre of the giant elliptical galaxy Messier 87?

Apakah Jenis lohong hitam yang diimej oleh Event Horizon Telescope (EHT) di pusat galaksi elips Mergasi, Messier 87?

- (A) Schwarzschild black hole / *Lohong hitam Schwarzschild*
- (B) Kerr black hole / *Lohong hitam Kerr*
- (C) Reissner-Nordstrom black hole / *Lohong hitam Reissner-Nordstrom*
- (D) Kerr-Newman black hole / *Lohong hitam Kerr-Newman*

18. Luke and Emma are talking on the phone while observing the Moon. Luke observes the Moon at an altitude of 15° over the eastern horizon, at what altitude is the moon as seen by Emma, assuming they are both standing at sea level?

Lukas dan Emma sedang bercakap di telefon sambil memerhatikan Bulan. Lukas memerhatikan Bulan pada ketinggian 15° di atas ufuk timur. Berdasarkan jadual di bawah, Apakah altitud Bulan seperti yang dicerap oleh Emma, dengan menganggap mereka berdua berada di paras laut?

Location / <i>Lokasi</i>	Latitude / <i>Latitud</i>	Longitude / <i>Longitud</i>
Luke	2° N / 2° U	121° East / 121° Timur
Emma	2° N / 2° U	101° East / 101° Timur

- (A) 35° over the eastern horizon / *35° di atas ufuk timur*
- (B) 15° over the eastern horizon / *15° di atas ufuk timur*
- (C) 15° over the western horizon / *15° di atas ufuk barat*
- (D) Emma cannot actually see the Moon / *Emma tidak dapat melihat Bulan*

19. The Tully-Fisher Relationship is an empirical observational relationship:

Hubungan Tully-Fisher adalah hubungan pemerhatian empirikal:

- (A) Between the luminosities of a spiral or irregular galaxies and their rotational velocities
Antara kilauan lingkaran galaksi berpilin atau galaksi tidak teratur dan halaju putaran mereka
- (B) Between the orbital speeds of the visible stars in a galaxy versus their radial distance from the galaxy's center
Antara kelajuan orbital bintang-bintang yang kelihatan dalam galaksi berbanding jarak jejari dari pusat galaksi
- (C) Between the distance of galaxies and their recessional velocities
Antara jarak galaksi-galaksi dan pemerosotan halaju mereka
- (D) Between the luminosities of Cepheid Variables and their pulsation periods
Antara kilauan Cepheid Bolehubah dan tempoh denyutannya

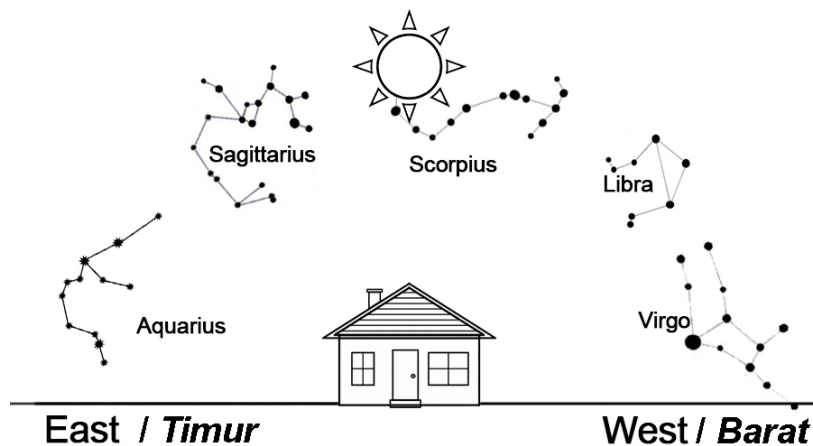
20. What is the smallest angular separation between a binary star system, that a 40-inch aperture telescope can be used, if it is observing in the 700 nm band-pass?

Apakah sudut pemisahan terkecil antara sistem bintang binari, yang boleh dicerap menggunakan teleskop 40-inci teleskop, jika ia mencerap menggunakan jalur band 700 nm?

- (A) 0.170" (B) 0.004" (C) 0.0000482" (D) 0.000001223"

21. Figure below shows the position of the Sun as seen in the sky at noon time. Where is the Sun positioned six hours later?

Rajah di bawah menunjukkan posisi Matahari seperti yang terlihat di langit pada waktu tengah hari. Di manakah kedudukan Matahari enam jam kemudian?



- (A) Around Virgo constellation / *Sekitar buruj Virgo*
 (B) Around Aquarius constellation / *Sekitar buruj Aquarius*
 (C) Around Scorpius constellation / *Sekitar buruj Scorpius*
 (D) Around Libra constellation / *Sekitar buruj Libra*

22. Which of the following is NOT an accepted use of a Hertzsprung-Russell Diagram?

Antara berikut, yang manakah BUKAN kegunaan Rajah Hertzsprung-Russell?

- (A) Visual way to 'graph' and categorize stars based on their characteristics
Kaedah visual untuk menunjukkan 'graf' dan mengelaskan bintang-bintang mengikut ciri-ciri mereka
 (B) To track the life cycle of stars as they change over time
Untuk mengesan kitaran hidup bintang-bintang yang berubah mengikut masa
 (C) Allows astronomers to recognize patterns based on types of stars
Membolehkan ahli astronomi mengenal pasti corak-corak mengikut jenis bintang
 (D) To determine the distance between stars with great accuracy
Menentukan jarak-jarak antara bintang dengan tepat

23. A star is seen to move by 0.2 arcseconds between 1 February 2018 and 1 August 2018 and then back to its starting point on 1 February 2019. What is the parallax angle for this star, in arcseconds?

Sebuah bintang bergerak selama 0.2 arka-saat dari 1 Februari 2018 dan 1 Ogos 2018 dan kembali pada titik mula pada 1 Februari 2019. Apakah sudut paralaks bintang ini, dalam arka-saat?

- (A) 0.4 (B) 0.3 (C) 0.2 (D) 0.1

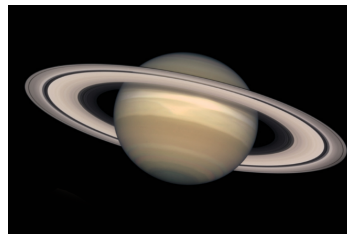
24. The following four Cepheid variable stars have the following periods: **Star 1 has a period of 2 days; Star 2 has a period of 5 days; Star 3 has a period of 30 days; Star 4 has a period of 50 days.** Which star is the most luminous?

*Empat bintang boleh ubah Cepheid mempunyai tempoh berikut: **Bintang 1 mempunyai tempoh 2 hari; Bintang 2 mempunyai tempoh 5 hari; Bintang 3 mempunyai tempoh 30 hari; Bintang 4 mempunyai tempoh 50 hari.** Bintang manakah yang paling berkilau?*

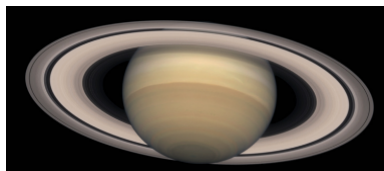
- (A) Star 1 / *Bintang 1* (B) Star 2 / *Bintang 2*
 (C) Star 3 / *Bintang 3* (D) Star 4 / *Bintang 4*

25. Figure below shows the appearance of Saturn, as seen at certain times. How would it look like after 3 hours?

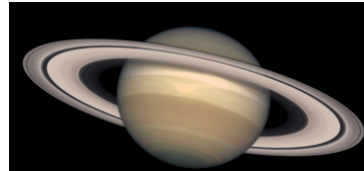
Rajah di bawah menunjukkan kemunculan Zuhal seperti yang dilihat pada masa-masa tertentu. Bagaimanakah rupa Zuhal selepas 3 jam?



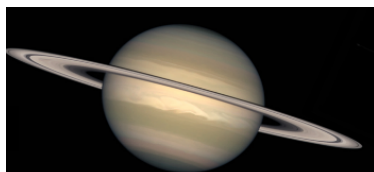
(A)



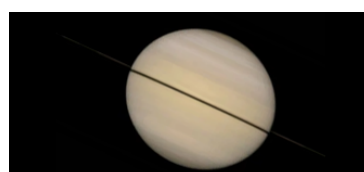
(B)



(C)



(D)



26. Which of the statement below correctly describes gravity according to Einstein's Theory of General Relativity?

Pernyataan manakah adalah benar untuk menghuraikan graviti mengikut Teori Relativiti Umum Einstein?

- (A) Matter tells spacetime how to curve and the curvature of spacetime tells matter how to move
Jirim mengakibatkan ruang-masa untuk membuat lengkungan dan lengkungan ruang-masa mengakibatkan jirim untuk bergerak
- (B) Every particle attracts every other particle in the universe with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centres
Setiap zarah menarik setiap zarah lain di dalam alam semesta dengan suatu daya yang berkadar terus dengan hasil darab jisim dan berkadar songsang dengan kuasa dua jarak antara pusat-pusat zarah
- (C) Matter and spacetime orbit around each other and this will emit gravitational waves
Jirim dan ruang-masa mengorbit sesama mereka lalu menghasilkan gelombang graviti
- (D) A mass of M_1 will orbit another mass of M_2 and this will emit gravitational waves
Satu jisim M_1 akan mengorbit suatu jisim M_2 dan menghasilkan gelombang graviti

27. A white dwarf is a very dense star, with mass comparable to that of the Sun, while its volume is comparable to that of the Earth. A white dwarf cannot collapse further, because:

Bintang kerdil putih ialah bintang yang sangat tumpat, dengan jisimnya setara dengan Matahari, manakala isi padunya setara dengan Bumi. Bintang kerdil putih tidak boleh memampat kerana:

- (A) It converts helium (He) to carbon (C)
Ia menukarkan helium (He) kepada karbon (C)
- (B) Its electrons cannot be squeezed together any more
Elektron-elektronnya tidak boleh dimampatkan lagi
- (C) Its protons cannot be squeezed together any more
Proton-protonnya tidak boleh dimampatkan lagi
- (D) The core of a white dwarf is made of dark energy, which is anti-gravity
Teras bintang kerdil putih dibuat daripada tenaga gelap yang bersifat anti graviti

28. When a massive star like Betelgeuse in ORION at the end of its life explodes as a supernova , it radiates most of its binding energy in the form of:

Apabila bintang besar seperti Betelgeuse dalam BELANTIK pada akhir hayatnya meletup sebagai supernova, ia memancarkan kebanyakan tenaga yang mengikatnya dalam bentuk:

- (A) Neutrinos / *Neutrino*
- (B) Gamma rays / *Sinar gamma*
- (C) X-rays / *Sinar X*
- (D) Energetic muons / *Muon bertenaga*

29. What is the name of the last stage of the evolution of Sun-sized stars?

Apakah nama peringkat akhir bagi evolusi bintang bersaiz Matahari?

- (A) White dwarf / *Bintang kerdil putih* (B) Black dwarf / *Bintang kerdil hitam*
(C) Brown dwarf / *Bintang kerdil perang* (D) Red dwarf / *Bintang kerdil merah*

30. The heavy element gold (Au) is created during nucleosynthesis by a process called rapid neutron capture in which an atomic nucleus quickly absorbs a series of neutrons to reach a stable form before it decays radioactively. Most of the gold in the universe was created during:

Elemen berat, Emas (Au) tercipta semasa nucleosintesis oleh satu proses yang dikenali penangkapan neutron pantas. Semasa proses ini, sebuah nukleus atomik dengan cepatnya menyerap satu siri neutron untuk mencapai satu bentuk stabil sebelum ia mereput secara radioaktif. Kebanyakan emas dalam alam semesta ini tercipta semasa:

- (A) The merger of a black hole with a neutron star / *Gabungan lohong hitam dan bintang neutron*
(B) The merger of two black holes / *Gabungan dua lohong hitam*
(C) The merger of two neutron stars / *Gabungan dua bintang neutron*
(D) The explosion of a supernova / *Letupan supernova*

31. On 10th April 2019, a groundbreaking announcement was made worldwide by the Event Horizon Telescope (EHT) Team concerning the first ever image of a black hole in the centre of the giant elliptical galaxy Messier 87. Which one of the following statements is INCORRECT?

Pada 10 April 2019, satu pengumuman tergempar dibuat oleh pasukan Event Horizon Telescope (EHT) berkenaan imej pertama lohong hitam di pusat galaksi elips gergasi, Messier 87. Yang manakah antara berikut merupakan pernyataan yang TIDAK BENAR?

- (A) The EHT is a planet-scale array of eight (8) ground-based radio telescopes with international collaboration
EHT ialah susunan berskala planet sebanyak lapan (8) teleskop radio darat dengan kolaborasi antarabangsa
- (B) The EHT made the observation of the black hole in Messier 87 at a wavelength of 1.5 mm and diffraction-limited resolution of 27 microarcseconds
EHT memerhatikan lohong hitam di Messier 87 pada jarak gelombang 1.5 mm dan resolusi had belauan 27 mikro arka-saat
- (C) The most important component telescope of the EHT is the Atacama Large Millimeter/submillimeter Array (ALMA) in Chile
komponen teleskop EHT yang paling penting ialah Atacama Large Millimeter/submillimeter Array (ALMA) di Chile
- (D) The scientific results were published on 10th April 2019 in a series of six papers in The Astrophysical Journal Letters
Penemuan saintifik diterbitkan pada 10 April 2019 dalam sebuah siri enam kertas dalam The Astrophysical Journal Letters

32. Which of the following sequence of the evolution of stars is INCORRECT?

Antara berikut susunan evolusi bintang manakah yang TIDAK BENAR?

(A) Small star → Red giant → Planetary nebula → White dwarf → Black dwarf

*Bintang kecil → Gergasi merah → Nebula planet → Bintang kerdil putih →
Bintang kerdil hitam*

(B) Large star → Red supergiant → Supernova → Black hole

Bintang besar → Bintang gergasi merah → Supernova → Lohong hitam

(C) Neutron star → Pulsar → Black hole

Bintang neutron → Pulsar → Lohong hitam

(D) Substellar object with mass between 13 to 80 times the mass of Jupiter →

A failed star called a brown dwarf

*Objek subnajak dengan jisim antara 13 hingga 80 kali ganda jisim Musytari →
Bintang gagal yang dikenali sebagai bintang kerdil perang*

33. Which of the following is NOT a studied characteristic of the astrochemistry of interstellar medium?

Antara berikut manakah BUKAN ciri-ciri astrokimia medium antara bintang yang dikaji?

(A) Interstellar atoms / *Atom antara bintang*

(B) Interaction of radiation with molecules / *Interaksi radiasi dengan molekul*

(C) Nucleosynthesis / *Nukleosintesis*

(D) Organics of interstellar origin / *Organik asal-usul antara bintang*

34. NASA launched the Transiting Exoplanet Survey Satellite (TESS) on 18th April 2018 on an ambitious mission to discover more exoplanets. What is the method used by TESS to discover exoplanets?

NASA melancarkan Satelit Peninjauan Eksoplanet Transit (TESS) pada 18 April 2018 dan satu misi impian untuk menjelajah lebih banyak eksoplanet. Apakah kaedah yang digunakan TESS untuk berbuat demikian?

(A) Radial Velocity Method / *Kaedah Halaju Radial*

(B) Transit Photometry Method / *Kaedah Fotometri Transit*

(C) Transit Timing Method / *Kaedah Masa Transit*

(D) Gravitational Lensing Method / *Kaedah Pengkantaan Graviti*

35. When studying the planets in the Solar System, astrobiologists who were looking for evidence of life forms, became excited when they detected the presence of gas methane. Which statement below that relates methane to the existence of life on planet Earth is INCORRECT?

Apabila planet-planet dalam Sistem Suria dikaji, ahli astrobiologi yang mencari bukti bentuk kehidupan, teruja apabila mereka mengesan kehadiran gas metana. Pernyataan yang manakah berkaitan dengan metana terhadap kewujudan kehidupan di planet Bumi adalah TIDAK BENAR?

- (A) Most of Earth's methane is biogenic and is produced by methanogenesis, a form of anaerobic respiration by microbes
Kebanyakan metana Bumi adalah biogenik dan dihasilkan oleh metanogenesis, suatu bentuk respirasi anaerobik oleh mikrob
- (B) After eating grass, cows and sheep produce a lot of methane
Selepas lembu dan kambing memakan rumput, mereka menghasilkan banyak metana
- (C) Draining paddy fields in the middle of the rice-growing season helps reduce the emission of methane gas
Pengeringan sawah padi di tengah-tengah musim menuai padi membantu mengurangkan pelepasan gas metana
- (D) Eruption of volcanoes and glaciers produce a lot of methane
Gangguan gunung berapi dan glasier menghasilkan banyak metana

36. What causes the spiral arms to form within a spiral galaxy?

Apa yang menyebabkan lengan spiral membentuk dalam galaksi berpilin?

- (A) Spiral compression waves / *Gelombang pemampatan galaksi berpilin*
- (B) Spiral longitudinal waves / *Gelombang longitud galaksi berpilin*
- (C) Spiral density waves / *Gelombang ketumpatan galaksi berpilin*
- (D) Spiral gravity waves / *Gelombang graviti galaksi berpilin*

37. Which classification of meteorites below is the correct one?

Klasifikasi meteorit manakah yang benar?

- (A) Stony meteorites, stony-iron meteorites and iron meteorites
Meteorit berbatu, meteorit besi berbatu dan meteorit besi
- (B) Stony meteorites, nickel-iron meteorites and iron meteorites
Meteorit berbatu, meteorit nikel-besi dan meteorit besi
- (C) Chondrite meteorites, stony-iron meteorites and iron meteorites
Meteorit chondrite, meteorit besi berbatu dan meteorit besi
- (D) Stony meteorites, stony-iron meteorites and nickel meteorites
Meteorit berbatu, meteorit besi berbatu dan meteorit nikel

38. 2500 years ago, the Babylonians discovered the Saros Cycle in the Middle-East. The Saros Cycle is related to the movements of the Moon and the Sun and with this knowledge, the Babylonians were able to predict accurately when solar and lunar eclipses will occur. How long is the Saros Cycle?

2500 tahun yang lalu, orang Babylon menemui Kitaran Saros di Timur Tengah. Kitaran Saros berkaitan dengan pergerakan Bulan dan Matahari dan dengan pengetahuan ini orang-orang Babylon dapat meramalkan dengan tepat bila gerhana Matahari dan Bulan akan berlaku. Berapa lamakah Kitaran Saros?

- (A) 15 years 11 days and 8 hours / *15 tahun 11 hari dan 8 jam*
- (B) 16 years 11 days and 8 hours / *16 tahun 11 hari dan 8 jam*
- (C) 17 years 11 days and 8 hours / *17 tahun 11 hari dan 8 jam*
- (D) 18 years 11 days 8 hours / *18 tahun 11 hari dan 8 jam*

39. A man weighs 80 kg. Imagine that this man is squeezed into a tiny point until it becomes a black hole. What is the radius of the Schwarzschild Radius (event horizon) of this black hole?

Seorang lelaki mempunyai berat 80 kg. Bayangkan lelaki tersebut dimampatkan menjadi titik kecil sehingga menjadi lohong hitam. Apakah jejari Schwarzschild Radius (ufuk peristiwa) lubang hitam ini?

- (A) 1.62×10^{-35} m
- (B) 1.19×10^{-25} m
- (C) 2.23×10^{-11} m
- (D) 5.63×10^{-3} m

40. Astronomers and astrophysicists are conducting theoretical and experimental researches to find out if the MULTIVERSE could exist. What is a MULTIVERSE?

Ahli astronomi dan pakar astrofizik menjalankan penyelidikan teoretikal dan eksperimen untuk mengetahui sama ada MULTIVERSE boleh wujud. Apakah MULTIVERSE?

- (A) It is the complete collection of all types of exoplanets and alien civilizations that can possibly exist in the universe

Ia adalah koleksi lengkap semua jenis exoplanets dan tamadun asing yang mungkin boleh wujud di alam semesta

- (B) It is a hypothetical group of parallel universes

Ia adalah kumpulan hipotesis alam semesta yang selari

- (C) It is a type of universe which has many dimensions, more than the four dimensions (x, y, z, t) in our own universe

Ia adalah sejenis alam semesta yang mempunyai banyak dimensi, lebih banyak daripada empat dimensi (x, y, z, t) di alam semesta kita sendiri

- (D) It is a special type of universe predicted by Superstring Theory

Ia adalah sejenis alam semesta khas yang diramalkan oleh Teori Superstring

END OF OBJECTIVE QUESTIONS

SOALAN OBJEKTIF TAMAT

SUBJECTIVE QUESTION

SOALAN SUBJEKTIF



1. On 1st July 2019, the well-known Malaysian astrophotographer, William Chin captured a video of the International Space Station (ISS) crossing the disk of the Sun near the Maju Expressway (MEX), please see the figure above. The total duration of the ISS solar transit is 0.58 second. The time interval between two successive ISS images is 0.034 second. With this information, calculate the time taken the ISS to make one orbit around the Earth.

Pada 1 Julai 2019, jurugambar astronomi Malaysia yang terkenal, William Chin telah merekod video berkenaan Stesen Angkasa Antarabangsa (ISS) yang melintasi cakera Matahari berhampiran Maju Expressway (MEX), sila lihat rajah di atas. Jumlah tempoh transit solar ISS adalah 0.58 saat. Selang masa antara dua imej ISS berturut-turut adalah 0.034 saat. Dengan maklumat ini, hitungkan masa yang diambil ISS untuk membuat satu orbit mengelilingi Bumi.

[10 marks]

[10 markah]

END OF SUBJECTIVE QUESTION

SOALAN SUBJEKTIF TAMAT



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