**MyAO Format**

**30 OJECTIVE QUESTION.**

**Choose only ONE (1) correct answer for each question.** ***30 SOALAN OBJEKTIF. Pilih SATU (1) sahaja jawapan yang betul bagi setiap soalan.***

**MyAO Format**

**Lower Secondary- 13-15 y.o.**

**Upper Secondary- 16-18 y.o.**

***Menengah Rendah - 13-15 tahun***

***Menengah Atas - 16-18 tahun***

**MyAO Format**

1 SUBJECTIVE QUESTION.
*1 SOALAN SUBJEKTIF*

**MyAO Format**

2 Hours 30 Minutes
2 Jam 30 Minit

## List of Formula & Constant

### Fundamental Formula

Magnification, $M = \frac{v}{u} = \frac{I}{O}$

Centripetal force, $F = \frac{mv^2}{r} = m\omega^2 r$

Newton's law of Universal Gravitation, $F = \frac{Gm_1m_2}{r^2}$

Center of mass, $x_m = \frac{1}{M}\Sigma M_i x_i$, $M =$ total mass

3rd and 2nd Kepler Law, $\frac{a^3}{P^2} = \frac{G(m_1+m_2)}{4\pi^2}$

### Fundamental Constants

$g = 9.80$ m s$^{-2}$

$c =$ speed of light in vacuum $= 3.00 \times 10^8$ ms$^{-1}$

$G =$ constant of gravitation $= 6.674x10^{-11}$ Nm$^2$kg$^{-2}$

$A =$ solar constant $= 1367$ Wm$^{-}2$

## Senarai Formula & Pemalar

### Formula Asas

Pembesaran, $M = \frac{v}{u} = \frac{I}{O}$

Daya memusat, $F = \frac{mv^2}{r} = m\omega^2 r$

Hukum Gravitasi Universal Newton, $F = \frac{Gm_1m_2}{r^2}$

Pusat jisim, $x_m = \frac{1}{M}\Sigma M_i x_i$, $M =$ jumlah jisim

Hukum Kepler ke-3 dan ke-2, $\frac{a^3}{P^2} = \frac{G(m_1+m_2)}{4\pi^2}$

### Pemalar Asas

$g = 9.80$ m s$^{-2}$

$c =$ kelajuan cahaya dalam vakum $= 3.00 \times 10^8$ ms$^{-1}$

$G =$ pemalar gravitasi $= 6.674x10^{-11}$ Nm$^2$kg$^{-2}$

$A =$ pemalar solar $= 1367$ Wm$^{-}2$

## OBJECTIVE QUESTION

## *SOALAN OBJEKTIF*

**1.** As seen from the Earth, the stars appear to twinkle, while the planets do not because

*Daripada sudut pandangan Bumi, kemunculan bintang-bintang kelihatan berkelip, manakala planet-planet tidak kerana*

(**A**) Light coming from the stars gets absorbed by interstellar dust
*Cahaya yang muncul daripada bintang diserap oleh debu antara najam*

(**B**) the stars are self-luminous while the planets merely reflect the light
*Bintang-bintang tersebut swakilau (memancarkan cahaya dengan sendirinya) manakala planet-planet pula hanya memantulkan cahaya*

(**C**) Angular sizes of the stars are much smaller than the planets
*Saiz sudut bintang jauh lebih kecil berbanding planet*

(**D**) All of the above
*Kesemua diatas*

### SOLUTION / PENYELESAIAN

**Answer / *Jawapan*: C**

Stars are so distant that they appear as pinpoints of light in the night sky, even when viewed through a telescope.
Because all the light is coming from a single point, its path is highly susceptible to atmospheric interference.
Planets on the other hand is closer to Earth, making it appears bigger and thus less susceptible to atmospheric turbulence.

*Bintang-bintang begitu jauh sehinggakan ia muncul sebagai cahaya berbintik halus di langit pada waktu malam, walaupun dilihat melalui teleskop.*
*Hal ini kerana, kesemua cahaya yang muncul daripada satu titik tunggal, amat mudah terdedah kepada gangguan atmosfera.*
*Bagi planet pula, jaraknya lebih dekat dengan Bumi, menjadikan ia muncul dengan saiz yang lebih besar dan kurang terdedah kepada gelora atmosfera.*

**2.** If you hold a magnifying glass of focal length 10 cm in the sunlight and place a piece of paper at its focus, you can burn a hole in the paper. What could be the size of this hole?

[Radius of sun = $7 \times 10^8$ m, Distance between sun and earth = 500 $c$ ]

*Jika anda memegang suatu kanta pembesar dengan jarak fokus 10 cm di bawah cahaya matahari dan meletakkan sekeping kertas pada fokusnya, anda boleh menyebabkan pembakaran berlubang keatas kertas. Apakah saiz yang mungkin bagi lubang tersebut?*

*[Jejari Matahari = $7 \times 10^8$ m, Jarak antara Matahari dan Bumi = 500 c ]*

(**A**) 10 mm

(**B**) 5 mm

(**C**) 0.5 mm

(**D**) 0.1 mm

## SOLUTION / PENYELESAIAN

**Answer / *Jawapan*: C**

If the magnification is given by $M$, Object distance, object size, Image Distance, Image size by $u$, $O$, $v$, $I$ respectively,

$$M = \frac{v}{u} = \frac{I}{O} \qquad \& \qquad \frac{1}{7 \times 10^8} \approx \frac{f}{500c}$$

$$\begin{aligned} I &= \frac{0.1 \times 7 \times 10^8}{500 \times 3 \times 10^8} \\ &\approx \frac{7}{15} \times 10^{-3} \text{ m} \\ &\approx 0.5 \text{ mm} \end{aligned}$$

Jika pembesaran diberikan oleh $M$, manakala jarak objek, saiz objek, jarak imej, saiz imej masing-masing diberikan sebagai $u$, $O$, $v$, $I$, maka diperoleh

$$M = \frac{v}{u} = \frac{I}{O} \qquad \& \qquad \frac{1}{7 \times 10^8} \approx \frac{f}{500c}$$

$$\begin{aligned} I &= \frac{0.1 \times 7 \times 10^8}{500 \times 3 \times 10^8} \\ &\approx \frac{7}{15} \times 10^{-3} \text{ m} \\ &\approx 0.5 \text{ mm} \end{aligned}$$

**3.** A certain person nicknamed "Ali", encountered an automatic staircase (i.e. escalator) at a shopping complex, which was moving upward at a constant rate. Just for the fun of it he decided to walk up this escalator at the rate of one step a second. Twenty steps bring him to the top. Next day he goes up at two steps a second and reaching the top in 32 steps. How many steps are there in the escalator?

*Ali menemukan sebuah tangga automatik (contoh: eskalator) di sebuah pusat beli belah, yang bergerak keatas pada kadar yang malar. Ali membuat keputusan untuk menaiki tangga tersebut pada kadar satu langkah sesaat. Untuk tiba di puncak, Ali memerlukan dua puluh langkah. Keesokan harinya, Ali menaiki tangga tersebut pada kadar dua saat bagi setiap langkah dan tiba di bahagian puncak dengan 32 langkah. Berapakah jumlah langkah pada eskalator tersebut?*

(**A**) 40
(**B**) 60
(**C**) 64
(**D**) 80

**SOLUTION / PENYELESAIAN**

**Answer / *Jawapan*: D**

Let the escalator rise with the speed of 'n' steps per second. On first day, Ali reaches the top after 20 manual steps i.e. in 20 seconds. On second day, Ali reaches the top after $\frac{32}{2} = 16$ seconds. Thus, the total number of steps is

$$\begin{aligned} 20 \times (n+1) &= 16 \times (n+2) \\ 4n &= 32 - 20 = 12 \\ n &= 3 \end{aligned}$$

$\therefore$ Steps $\Rightarrow 20 \times (3+1) = 80$

Andaikan eskalator bergerak keatas dengan kelajuan 'n' langkah sesaat. Pada hari pertama, Ali tiba di puncak selepas 20 langkah manual (cthnya: dalam 20 saat). Pada hari kedua, Ali tiba di puncak selepas $\frac{32}{2} = 16$ saat. Maka, jumlah langkah ialah

$$\begin{aligned} 20 \times (n+1) &= 16 \times (n+2) \\ 4n &= 32 - 20 = 12 \\ n &= 3 \end{aligned}$$

$\therefore$ *Langkah* $\Rightarrow 20 \times (3+1) = 80$

**4.** Two stars masses $M$ and $3M$ respectively are going around each other, in near circular orbits, with period $T$. The separation between them is given by $D = \sqrt[3]{\dfrac{kGMT^2}{\pi^2}}$. What is the value of $k$?

*Dua bintang masing-masing berjisim M dan 3M saling mengelilingi antara satu sama lain, dalam bulatan orbit yang berhampiran, dengan tempoh T. Jarak antara kedua-dua bintang tersebut diberikan oleh* $D = \sqrt[3]{\dfrac{kGMT^2}{\pi^2}}$. *Apakah nilai bagi k?*

(**A**) 0.5

(**B**) 1

(**C**) 1.5

(**D**) 3

**SOLUTION / PENYELESAIAN**

**Answer *Jawapan*: B**

The center of mass of the system will be located as distance $\dfrac{D}{4}$ from the heavier mass. Centripetal force is provided by the mutual gravitation.

$$\begin{aligned}\frac{GM(3M)}{D^2} &= (3M)\frac{D}{4}\omega^2 \\ \frac{GM}{D^2} &= \frac{D}{4}\frac{4\pi^2}{T^2} \\ D^3 &= \frac{GMT^2}{\pi^2} \\ D &= \sqrt[3]{\frac{GMT^2}{\pi^2}}\end{aligned}$$

*Pusat jisim bagi sistem terletak sebagai jarak* $\dfrac{D}{4}$ *daripada jisim yang lebih berat. Daya memusat bersamaan dengan daya graviti.*

$$\begin{aligned}\frac{GM(3M)}{D^2} &= (3M)\frac{D}{4}\omega^2 \\ \frac{GM}{D^2} &= \frac{D}{4}\frac{4\pi^2}{T^2} \\ D^3 &= \frac{GMT^2}{\pi^2} \\ D &= \sqrt[3]{\frac{GMT^2}{\pi^2}}\end{aligned}$$

**5.** Which of the following observations does **NOT** support the statement that "Every system tends to configure itself to have minimum Potential Energy".

*Antara pemerhatian berikut, yang manakah **TIDAK** menyokong pernyataan "Setiap sistem cenderung untuk membentuk dengan sendirinya untuk mempunyai Tenaga Keupayaan minimum".*

(**A**) Andromeda galaxy and Milky Way are approaching each other
*Galaksi Andromeda dan Bima Sakti menghampiri satu sama lain*

(**B**) Two unlike, free charges move towards each other
*Dua caj bebas yang tidak serupa bergerak kearah satu sama lain*

(**C**) External work is required to compress a spring
*Kerja luaran diperlukan untuk memampatkan suatu spring*

(**D**) Light iron dust moves towards powerful magnet in close vicinity
*Debu besi ringan bergerak kearah tarikan magnet yang kuat di kawasan berhampiran*

**SOLUTION / PENYELESAIAN**

**Answer / *Jawapan*: A**

Andromeda Galaxy and the Milky Way are moving around the centre of our local group of galaxies. In the course of this motion, they just happen to be coming closer to each other.
Their mutual gravitational attraction does not play any significant role in this motion.

*Galaksi Andromeda dan Bima Sakti bergerak di sekitar pusat bagi kumpulan galaksi yang diduduki planet bumi.*
*Tarikan graviti tidak memainkan peranan dalam pergerakan tersebut kerana secara tidak sengaja jarak Galaksi Andromeda dan Bima Sakti berdekatan antara satu sama lain pada masa tersebut.*

**6.** Which of the following phenomena is **NOT** useful, in estimating distances in the Universe?

*Antara berikut, fenomena manakah yang **TIDAK** dapat digunakan bagi penganggaran jarak dalam alam semesta?*

(**A**) Sometimes Venus can be seen transiting over the solar disc
*Kadang kala Zuhrah dapat dilihat melintasi cakera solar*

(**B**) Stars with no proper motion appear to change their position in the sky when viewed six months apart
*Bintang dengan pergerakan yang tidak setara muncul untuk mengubah kedudukannya di langit apabila dilihat enam bulan berasingan*

(**C**) Stars exhibit Doppler shift
*Bintang-bintang mempamerkan anjakan Droppler*

(**D**) All supernovae of Type Ia have same absolute brightness
*Kesemua supernova Jenis Ia mempunyai kecerahan mutlak*

**SOLUTION / PENYELESAIAN**

**Answer / *Jawapan*: C**

With Doppler shift we can estimate the velocity of stars but not the distance.
The Earth-Sun distance was successfully estimated for the first time using Venus transit method.
Option (B) talks of parallax method. The absolute magnitudes of Supernovae is useful standard candle for cosmological distances.

*Penganggaran halaju bagi bintang-bintang boleh dilakukan dengan wujudnya anjakan Droppler tetapi penganggaran jarak tidak dapat dilakukan.*
*Jarak diantara Bumi dan matahari telah berjaya dianggarkan buat pertama kalinya menggunakan kaedah lintasan Zuhrah.*
*Pilihan (B) membincangkan tentang kaedah paralaks. Magnitud mutlak bagi kesemua Supernova adalah "standard candle" (piawaian) berguna bagi jarak kosmologi.*

**END OF OBJECTIVE QUESTION**
***SOALAN OBJEKTIF TAMAT***

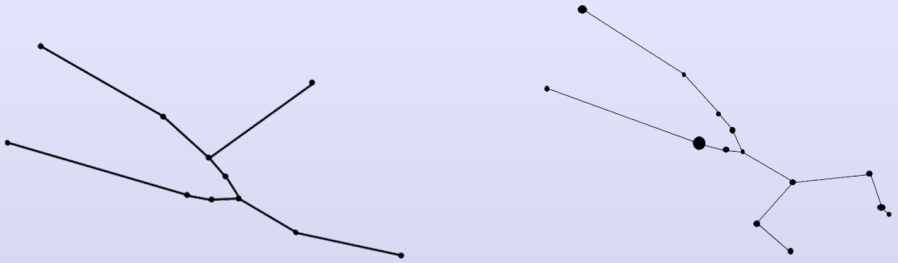
## SUBJECTIVE QUESTION

## *SOALAN SUBJEKTIF*

**1.** Draw, label and describe briefly about the constellation that contains two Messier object which is Messier 1 and Messier 45. This constellation belongs to the Zodiac family of constellation and also known as *the bull*.

*Lukis, label dan terangkan tentang buruj yang mengandungi dua objek Messier iaitu Messier 1 dan Messier 45. Buruj ini milik kepada keluarga buruj zodiak dan dikenali sebagai 'the bull'.*

### SOLUTION / PENYELESAIAN



- The name of the constellation is Taurus
- Taurus is one of the oldest constellation
- 17th largest constellation in the sky (occupying 797 square degrees)
- Located in the first quadrant of northern hemisphere (lies in the northern sky)
- The brightest stars in Taurus is Alpha Tauri (known as Aldebaran)
- Was first catalogued by Greek astronomer, Ptolemy in the 2nd century.
- Associated with two meteor showers

- *Nama buruj tersebut ialah Taurus*
- *Taurus merupakan salah satu buruj yang tertua*
- *Buruj ke-17 terbesar di langit (memenuhi 797 darjah persegi)*
- *Terletak pada kuadran pertama di hemisfera utara (terletak di langit utara)*
- *Bintang paling terang dalam Taurus ialah Alpha Tauri (dikenali sebagai Aldebaran)*
- Yang pertama dikatalogkan oleh ahli astronomi Greek, Ptolemy pada abad ke-2
- Terhubung dengan dua hujan meteor

**END OF SUBJECTIVE QUESTION**
***SOALAN SUBJEKTIF TAMAT***