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

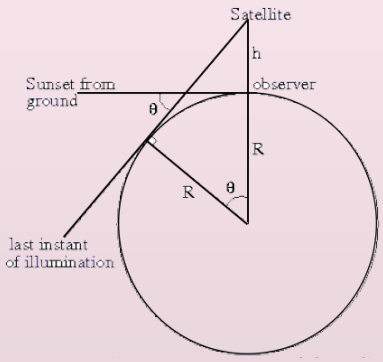
SOALAN OBJEKTIF

1. On one starry evening, Ramli was trying to spot an artificial polar satellite from her backyard. Typical altitude of any polar satellite is about 800km above surface of the earth. What is the typical duration after sunset for which Nidhi should try her luck?

(**A**) 63 minutes
(**B**) 109 minutes
(**C**) 127 minutes
(**D**) 171 minutes

SOLUTION / PENYELESAIAN

Answer / *Jawapan*: B



Height of the orbit of polar satellite is 800 Km. After Sunset, the Sunlight will reach satellite for a time $\frac{\theta}{\omega}$, where ω is the angular velocity of the earth and θ is as shown in the diagram.

$$\omega = \frac{15^\circ}{hour}$$
$$\theta = \cos^{-1}\left(\frac{R}{R+H}\right)$$
$$\theta = \cos^{-1}\left(\frac{6.4\times10^6}{6.4\times10^6+8\times10^5}\right)$$
$$\theta = \cos^{-1}\left(\frac{8}{9}\right) = \cos^{-1}(0.889)$$
$$\theta \leq \cos^{-1}(0.866) = 30^\circ$$

The angle is slightly less than 30°. Thus, for this angle, time will be slightly less than 2 hours.

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2. If the square of your age in seconds gives the age of the Universe in seconds, then

(**A**) you haven't started to walk yet
(**B**) you are in primary school
(**C**) you are a young adult
(**D**) you were born before Malaysia celebrate Merdeka

SOLUTION / PENYELESAIAN

Answer / *Jawapan*: C

Age of the Universe is about 14 billion years. If your age in years is Y , then,

$$(Y\ years \times 365.25\ days \times 86400\ seconds)^2 = 14 \times 10^9 \times 365.25 \times 86400$$
$$Y^2 = \frac{14 \times 10^9}{365.25 \times 86400}$$
$$\approx \frac{14}{28} \times 10^3 \approx 500$$
$$Y \approx \sqrt{500} \approx 22\ years$$

Thus, your age is in early 20s.

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3. If $f(x+y) = f(x)f(y)$ and $f(2) = 5$, then the value of $f(-2)$ is

(**A**) 5
(**B**) 1
(**C**) 0.25
(**D**) 0.2

SOLUTION / PENYELESAIAN

Answer / *Jawapan*: D

Solution 1: $f(4) = f(2)f(2) = 25$ and $f(2) = f(4-2) = f(4)f(-2) = 25f(-2)$
Thus, $f(-2) = \dfrac{f(2)}{25} = \dfrac{5}{25} = 0.2$

Solution 2: $f(2) = f(2+0) = f(2)f(0)$ implying $f(0) = 1$
Thus, $f(0) = f(2-2) = f(2)f(-2)$
Giving, $f(-2) = \dfrac{f(0)}{f(2)} = \dfrac{1}{5} = 0.2$

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4. An electron moving uniformly in space is neither deflected nor accelerated over a long distance. Which of the following statements may describe the local conditions?

(**A**) Both electric and magnetic fields are necessarily zero simultaneously.

(**B**) The electric field is necessarily zero.

(**C**) The magnetic field is necessarily zero.

(**D**) Neither of them is necessarily zero.

SOLUTION / PENYELESAIAN

Answer *Jawapan*: B

The Lorentz force equation is given by, $F \sim = q(E \sim + \sim v \times B \sim)$
We require $F \sim$ to be zero. The electric and magnetic fields can be so adjusted that their net effect cancels out, and the electron continues its path.

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5. Ali once observed image of the sun on the floor of his school hall and realized that the sun rays forming the image are entering through a tiny square shaped window in the high ceiling. He measured the diameter of the image to be 0.175 m. Find the height of the ceiling.

(**A**) 12.5 m

(**B**) 18.75 m

(**C**) 22.5 m

(**D**) 37.5

SOLUTION / PENYELESAIAN

Answer / *Jawapan*: B

h= height of the ceiling, distance of the sun= $D_{se} = 1.5 \times 10^1 1$ m; w = diameter of the image, $d = 14 \times 10^8$ = diameter of the sun.

$$\frac{h}{w} \approx \frac{D_{se}}{d}$$

$$h \approx 0.175 \times \frac{1.5 \times 10^{11}}{14 \times 10^8} \approx 18.75\ m$$

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6. The Sun is found to be setting exactly at 6.00 pm on a given day. If the Earth's atmosphere was only half dense as it is then the sunset would have occurred

(**A**) Slightly later than 6.00 pm

(**B**) Slightly earlier than 6.00 pm

(**C**) Exactly at 6.00 pm

(**D**) It depends on the latitude of the place.

SOLUTION / PENYELESAIAN

Answer / *Jawapan*: B

We "see" the sunset a few minutes after geometric sunset as the solar disk remains visible even after going below horizon due to refraction. If the atmosphere is rarer, the sunrays will get refracted less. Thus, this additional period of visibility of solar disk is reduced. Hence, we will "see" sunset slightly earlier.

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7. Consider the following statements:

- A central eclipse is the one where central point of lunar disk exactly passes over the central point of solar disk.
- An eclipse is called a total Eclipse if it is seen as total from at least some point on the earth.
- An eclipse is called a partial Eclipse if it is not seen as total / annular from any point on the earth.

Which of the statements below is correct?

(**A**) All central eclipses are total.
(**B**) All total eclipses are central.
(**C**) All partial eclipses are non-central.
(**D**) All non-central eclipses are partial.

SOLUTION / PENYELESAIAN

Answer / *Jawapan*: C

First one is incorrect as some central eclipses can be annular only. Second one is incorrect as one can get a total eclipse even when the two disks are slightly off-center w.r.t. to each other. Third one is correct. Fourth one is incorrect for the reason explained above regarding the second option.

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8. Which of the following phenomena is **not** being used by astronomer in estimating distances in the Universe?

(**A**) Sometime Venus can be seen transiting over the solar disc.

(**B**) Stars with no proper motion appear to change their position in the sky when viewed six months apart.

(**C**) Stars exhibit Doppler shift.

(**D**) All supernovae of Type Ia have same absolute brightness.

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 a useful standard candle for cosmological distances.

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9. It is easier to balance on a faster bicycle moving along a straight line than a slower one because of

(**A**) conservation of linear momentum.

(**B**) conservation of angular momentum.

(**C**) conservation of linear momentum and angular momentum.

(**D**) conservation of energy.

SOLUTION / PENYELESAIAN

Answer / *Jawapan*: B

Spinning wheels have angular momentum, and when you're sitting on a bike, you and it and its wheels make up a system that obeys the principle of conservation of angular momentum. Unless torque, or twisting force, is applied from outside the system to change the wheels' angular momentum, that momentum and the direction of the momentum remain constant. In a nutshell, once the wheels line up a certain way, they want to stay lined up like that. It's easy for you to move them, but hard for an outside force to do the same, and so the bike is easy to keep balanced but doesn't topple easily. A non-moving bike has wheels that aren't spinning and zero angular momentum, which makes it very easy for external torque to change the wheels' direction, making the bike harder to balance.

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10. On which side of the Moon-nearside or farside-the night is longer?

(**A**) Near side.

(**B**) Far side.

(**C**) Both side experience the same length of night.

(**D**) Near side never experience night and far side always experience night.

SOLUTION / PENYELESAIAN

Answer / *Jawapan*: B

The Moon rotates on its axis while orbiting the Earth. The period of orbit is the same as of rotation, which makes it appears to show the same side to Earth observer. However, both side on the Moon still experience regular day and night rotation.

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END OF OBJECTIVE QUESTION
SOALAN OBJEKTIF TAMAT

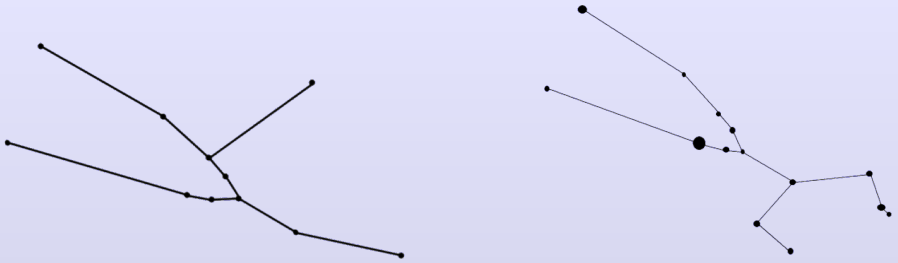
SUBJECTIVE QUESTION

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