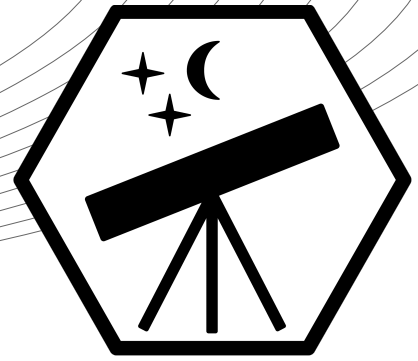


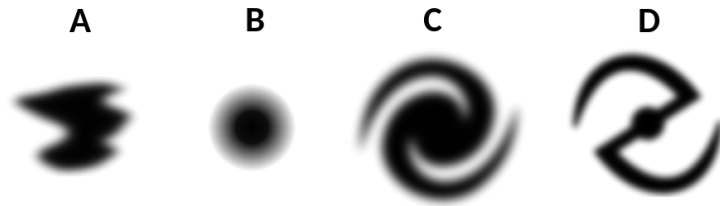
# International Astronomy and Astrophysics Competition Final Round



## **Final Round Exam 2023**

The final round exam was given in the form of an online exam.  
Each participant was given a subset of 20 questions in random order.  
This paper version is only available for training purposes.

**Question 1 :** Which one of these shapes illustrates an **elliptical galaxy**?:



(A) A

(B) B

(C) C

(D) D

**Question 2 :** What is the class of this galaxy?:



(A) Spiral

(B) Barred Spiral

(C) Lenticular

(D) Elliptical

**Question 3 :** Which class of galaxies does this shape illustrate?:



(A) Barred Spiral

(B) Lenticular

(C) Elliptical

(D) Irregular

**Question 4 :** The speed of light is approximately ...

(A)  $3 \cdot 10^3$  km/s

(B)  $3 \cdot 10^5$  km/s

(C)  $3 \cdot 10^6$  km/s

(D)  $3 \cdot 10^9$  km/s

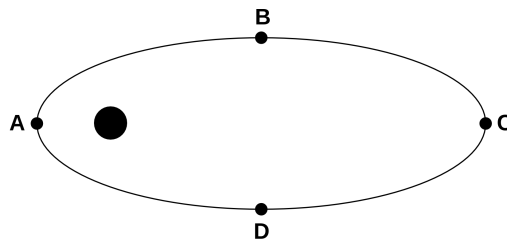
**Question 5 :** What is the most common type of galaxy in the universe?

- (A) Spiral galaxy (B) Lenticular galaxy  
(C) Irregular galaxy (D) Elliptical galaxy
- 

**Question 6 :** How far away from Earth is a star with an observed parallax of 0.1 arcsecs?

- (A) 1 pc (B) 3 pc (C) 10 pc (D) 30 pc
- 

**Question 7 :** Which one of these points is the **aphelion** of the ellipse?



- (A) A (B) B (C) C (D) D
- 

**Question 8 :** What is true about the orbit of a comet called **C/2023 A3**?

- (A) non-periodic orbit (B) periodic orbit  
(C) elliptical orbit (D) no meaningful orbit
- 

**Question 9 :** The term **dark energy** is related to ...

- (A) the gravitation of black holes. (B) the matter in the universe.  
(C) the rotation of galaxies. (D) the expansion of the universe.
- 

**Question 10 :** Which landforms near the Zhurong landing site on Mars are likely related to volcanism?

- (A) Rampart craters, Ridges, Troughs (B) Ridges, Rampart craters, Transverse aeolian ridges  
(C) Ridges, Cones, Transverse aeolian ridges (D) Cones, Ridges, Troughs
-

**Question 11 :** The gravitational acceleration at the surface of a star with average density  $\rho$  and radius  $R$  is given by ...

- (A)  $\frac{4}{3}\pi G\rho R$  (B)  $\frac{4}{3}\pi G\rho R^2$   
(C)  $\frac{4}{3}\pi G\rho R^3$  (D)  $\frac{4}{3}\pi G\rho/R$
- 

**Question 12 :** The Zhurong Mars rover landed at an elevation of around ...

- (A)  $-8,000$  metres (B)  $-4,000$  metres  
(C)  $4,000$  metres (D)  $8,000$  metres
- 

**Question 13 :** Which instrument onboard the Zhurong Mars rover measures the magnetic field?

- (A) RoMAG (B) RoPeR (C) MarSCoDe (D) NaTeCams
- 

**Question 14 :** Which object was historically the reference value  $m_0$  for the **apparent magnitude**?

- (A) The Sun (B) North/Pole Star  
(C) Sirius (star) (D) Vega (star)
- 

**Question 15 :** About how much brighter is a star with an apparent magnitude of  $m = 1$  compared to a star with an apparent magnitude of  $m = 2$ ?

- (A) 2.5-times brighter (B) 5.0-times brighter  
(C) 10-times brighter (D) 25-times brighter
- 

**Question 16 : Hydrostatic equilibrium** can best be described as the equilibrium between ...

- (A) temperature and pressure. (B) friction and pressure.  
(C) density and pressure. (D) gravity and pressure.
- 

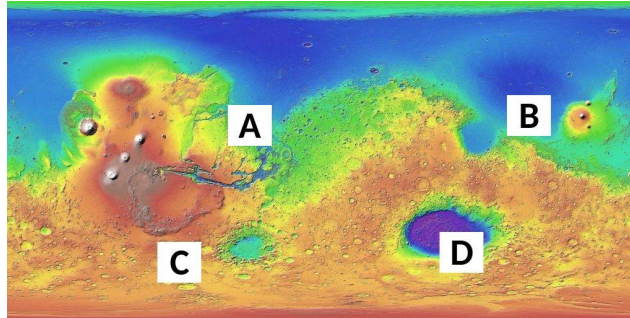
**Question 17 :** The ideal gas law states that ...  $(T$ : temperature,  $p$ : pressure,  $V$ : volume,  $N$ : number of particles,  $k$ : Boltzmann constant)

- (A)  $pV = Nk/T$  (B)  $pT = NkV$  (C)  $pT = Nk/V$  (D)  $pV = NkT$
-

**Question 18 :** How long is a year on Mars?

- (A)  $\approx$  300 Earth-days                      (B)  $\approx$  500 Earth-days  
(C)  $\approx$  700 Earth-days                      (D)  $\approx$  1,000 Earth-days
- 

**Question 19 :** Where on Mars did the Zhurong rover of the Tianwen-1 mission land?



- (A) Site A                      (B) Site B                      (C) Site C                      (D) Site D
- 

**Question 20 :** The colour of light with a wavelength of 700 nanometers is ...

- (A) Green                      (B) Blue                      (C) Yellow                      (D) Red
- 

**Question 21 :** How high was the star formation rate in the Galactic Center in the past 10-100 billion years?

- (A) 0.01 solar masses per year                      (B) 0.1 solar masses per year  
(C) 10 solar masses per year                      (D) 100 solar masses per year
- 

**Question 22 :** The two young massive clusters near the Galactic Centre are called ...

- (A) Sagittarius and Parsec                      (B) Sagittarius and Quintuplet  
(C) Arches and Parsec                      (D) Arches and Quintuplet
- 

**Question 23 :** How far away is the centre of the Milky Way from Earth?

- (A)  $\approx$  10,000 light-years                      (B)  $\approx$  25,000 light-years  
(C)  $\approx$  50,000 light-years                      (D)  $\approx$  100,000 light-years
-

**Question 24 :** The atmosphere of Mars consists primarily of ...

- (A) Nitrogen (B) Oxygen  
(C) Carbon dioxide (D) Carbon monoxide
- 

**Question 25 :** Approximately how many stars are there in the Milky Way?

- (A) 20 billion (B) 50 billion (C) 200 billion (D) 500 billion
- 

**Question 26 :** The bending of starlight when it passes through a gravitational field is called ...

- (A) stellar parallax (B) gravitational redshift  
(C) gravitational lensing (D) stellar occultation
- 

**Question 27 :** The outermost layer of the Sun that is visible during a total solar eclipse is called the ...

- (A) Corona (B) Photosphere (C) Chromosphere (D) Heliosphere
- 

**Question 28 :** The fusion process that generates the Sun's energy is called ...

- (A) Carbon-nitrogen-oxygen cycle (B) Triple-alpha process  
(C) Proton-proton chain (D) Bethe-Weise process
- 

**Question 29 :** How does the temperature of a star affect the distribution of photon energies it emits?

- (A) Higher temperature leads to higher-energy photons (B) Lower temperature leads to higher-energy photons  
(C) Photon energies are independent of temperature (D) None of the above applies
- 

**Question 30 :** The asteroid belt of the solar system is between the orbits of ...

- (A) Earth and Mars (B) Mars and Jupiter  
(C) Jupiter and Saturn (D) Saturn and Uranus
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