

MENTAL ABILITY

1. Complete the series:

1, 3, 10, 21, 64, 129, ?, 777

- (1) 356
- (2) 259
- (3)*388
- (4) 144

2. Write the number of the pair, the words of which do not have the same type of meaning as others.

- (1) Shade and Colour
- (2) Drink and Sip
- (3)*Short and Tall
- (4) Happy and Contented

3. It takes 2 minutes to boil a single egg. How many minutes will it take to boil 5 eggs together?

- (1) 10
- (2) 4
- (3)*2
- (4) 5

4. If fifth of the month falls two days after Monday, what day of the week will precede the 19th of the month?

- (1) Friday
- (2)*Wednesday
- (3) Saturday
- (4) Tuesday

5. If $2 \times 3 = 812$, $4 \times 5 = 1620$ then $6 \times 7 = ?$

- (1) 42
- (2) 1214
- (3)*2428
- (4) 2442

6. If March is to August, then C is to

- (1) G
- (2) I
- (3)*H
- (4) J

7. A lady is 5 years younger to her husband and he is 5 times as old as his daughter. If the daughter was 5 years old 3 years back, what is the present age of the lady?

- (1) 25
- (2) 45
- (3)*35
- (4) 30

8. Fill in the blank spaces in the series with appropriate choices:

2, 6, 5, 9, 8, 12, 11, 15,

- (1) 13, 17
- (2)*14, 18
- (3) 19, 23
- (4) 21, 25

9. Choose the number of the pair which is different from other pairs:

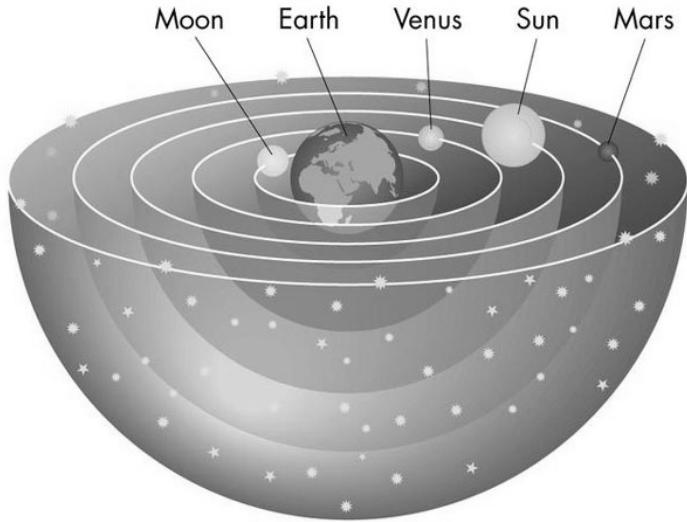
- (1) Head and Cap
- (2)*Pen and Pencil
- (3) Ink and Inkpot
- (4) Oil and Lamp

10. If $9 \times 7 = 3545$ and $4 \times 3 = 1520$ then $6 \times 8 = ?$

- (1) 5040
- (2) 6050
- (3)*4030
- (4) 3040

SPACE SCIENCE

11. Examine the diagram of the solar system below. Which of the following astronomers held and promoted this view of the solar system?



- (1) Aristarchus
 - (2)*Ptolemy
 - (3) Copernicus
 - (4) Tycho Brahe
12. Which of the following is evidence that Jupiter's composition is rich in hydrogen?
- (1) Its large mass
 - (2) Its large size
 - (3)*Its low density
 - (4) Its distance from the Sun
13. The atmosphere of Venus is composed primarily of:
- (1)*carbon dioxide
 - (2) sulphur dioxide
 - (3) sulphuric acid
 - (4) nitrogen
14. Why do Mercury and the Moon lack an atmosphere?
- (1) They formed after all the gas had been used up.
 - (2) They are so cold that all their gases have frozen into deposits below their surface.

- (3) They formed before the solar nebula had captured any gas.

- (4)*They are so small that their gravity is too weak to retain an atmosphere.

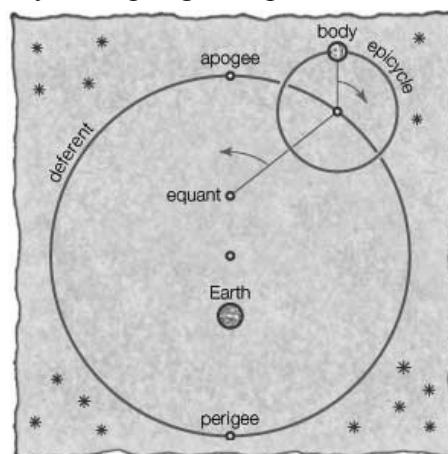
15. The core of a comet is composed of:

- (1) molten iron.
- (2)*frozen gases and ice.
- (3) liquid hydrogen.
- (4) uranium.

16. Why are most asteroids not spherical?

- (1)*Their gravity is too weak to pull them into a sphere.
- (2) The Sun's gravity distorts them.
- (3) Strong magnetic fields in their molten core make them lumpy.
- (4) The statement is false. Nearly all asteroids are spherical.

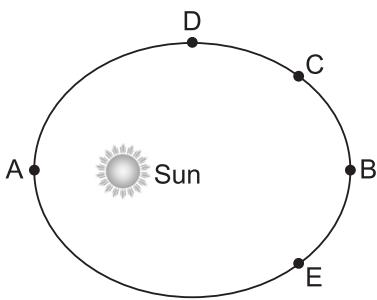
17. What is the following diagram developed by Ptolemy attempting to explain?



- (1) Geocentric model with stellar parallax
- (2) Heliocentric model
- (3)*Geocentric model with the retrograde motion of Mars
- (4) How the relative distance of the earth can be determined

- 18.** What causes meteor showers such as occur near August 12?
- The breakup of an asteroid in our upper atmosphere.
 - Bursts of particles ejected from the Sun.
 - A comet being captured into orbit around the Earth.
 - *The Earth passing through the tail of debris left by a comet.
- 19.** Which of the following show evidence of volcanic activity?
- Venus
 - Mars
 - Moon
 - * All of these
- 20.** If the earth is $1/4^{\text{th}}$ of its present distance from the sun, the duration of the year would be
- $1/4$ of the present year
 - $1/6$ of the present year
 - * $1/8$ of the present year
 - $1/16$ of the present year
- 21.** What kind of life do NASA scientists think they might find on Mars?
- *Bacterial
 - Viral
 - Algae
 - Fungi
- 22.** Quasars are at the _____ of the galaxies.
- head
 - legs
 - hands
 - * heart
- 23.** Kepler was the first astronomer to fit planetary orbits to
- Circles
 - Epicycles
 - Heliocentric models
 - *Ellipses
- 24.** Kepler's second law regarding constancy of arial velocity of a planet is a consequence of the law of conservation of
- energy
 - *angular momentum
 - linear momentum
 - acceleration
- 25.** A geostationary satellite is orbiting the earth at a height of $6R$ above the surface of the earth, R being the radius of the earth. The time period of another satellite at a height of $2.5 R$ from the surface of earth is
- * $6\sqrt{2}$ hr
 - 6 hr
 - $5\sqrt{2}$ hr
 - 10 hr
- 26.** The distance of Neptune and Saturn from the sun are nearly 10^{13} m and 10^{12} m respectively. Assuming that they move in circular orbits, their periodic times would be in the ratio of
- 10
 - 100
 - * $10\sqrt{10}$
 - 1000
- 27.** A planet moves around the sun. At a point A, it is closest from the Sun at a distance d_1 and has a speed v_1 . At another point B, when it is farthest from the sun at a distance d_2 , its speed will be
- * $\frac{d_1 v_1}{d_2}$
 - $\frac{d_2 v_1}{d_1}$
 - $\frac{d_1^2 v_1}{d_2^2}$
 - $\frac{d_2^2 v_1}{d_1^2}$
- 28.** Imagine a light planet revolving around a very massive star in a circular orbit of radius R with a period of revolution T . If the gravitational force of attraction between the planet and the star is proportional to $R^{-\frac{3}{2}}$ then
- $T^2 \propto R^2$
 - * $T^2 \propto R^{\frac{3}{2}}$
 - $T^2 \propto R^{\frac{1}{2}}$
 - $T^2 \propto R^3$

29. The planet mercury is revolving in an elliptical orbit around the sun as shown in figure. The kinetic energy of mercury will be greater at



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

30. Hubble's Law enables astronomers to estimate the distance to a galaxy if they can determine the galaxy's

- (1)*velocity of recession
- (2) mass
- (3) spectral type
- (4) temperature

31. Modern cosmology supposes that the Universe came from a "big bang" event about 13 billion years ago. Evidence for this is

- (1) the uniformity of the abundance of hydrogen and helium.
- (2) the cosmic background radiation.
- (3) the Hubble expansion.
- (4)*all of these

32. The age of a star cluster can be deduced from

- (1)*the turn-off point of stars on its main sequence.
- (2) the number of stars it contains.
- (3) its radial velocity.
- (4) its location in the Milky Way galaxy.

33. Hubble classified galaxies by their appearance. Which of the following types of galaxies do NOT fall on Hubble's tuning fork diagram?

- (1)*Peculiar galaxies
- (2) Spiral galaxies
- (3) Elliptical galaxies
- (4) Barred spiral galaxies

34. For main sequence stars, the general rule is: the higher the surface temperature, the

- (1) less luminous are the stars.
- (2) more numerous are the stars.
- (3)*greater the masses of the stars.
- (4) more common are binary stars.

35. Most stars are composed of

- (1) about 1/4 hydrogen and 3/4 helium.
- (2) mostly iron in their core.
- (3)*about 3/4 hydrogen and 1/4 helium.
- (4) equal parts hydrogen and helium.

36. The ecliptic plane is

- (1) the plane in which the Comets orbit the Sun.
- (2)*the plane in which the Planets orbit the Sun.
- (3) the plane in which the Moon orbits the Earth.
- (4) the plane in which the satellite Dactyl orbits the asteroid Ida.

37. The terrestrial planets are rocky because

- (1) the Sun converted all the hydrogen and helium in the inner Solar System into iron and nickel.
- (2) the Sun's gravity drew primarily heavy elements into the inner part of the early Solar System.
- (3) once planetesimals formed, the rocky ones drifted inward and the icy ones moved outward in the Solar System.
- (4)*only rocky material was able to condense in the hot inner parts of the early solar nebula.

- 38.** Star counting in the disk of the Milky Way galaxy cannot be used to locate the centre because
- the stars do not extend all the way to the centre.
 - *interstellar dust obscures all but the nearest stars.
 - the stars are not uniformly distributed in the disk.
 - there are too many stars to be counted.
- 39.** If an alien astronomer in a distant galaxy looks at the galaxies it can see, it will observe that
- half of the galaxies are moving away and half of them are moving toward it.
 - other galaxies are stationary.
 - *other galaxies are moving away from it.
 - other galaxies are moving toward it.
- 40.** In about 5 billion years, the sun will become
- a supernova
 - a black hole
 - *a red giant
 - a neutron star

INTERACTIVE SECTION

- 41.** In 2007, Voyager 2 crossed the heliosheath boundary and into the vast region at the edge of our solar system where the solar wind runs up against the thin gas between the stars. What did this crossing confirm about the shape of our solar system?
- *It's squashed
 - It's round
 - It's like a donut
 - It's a horseshoe shape
- 42.** To weigh roughly two-thirds less than what you do on Earth, which planet would you be on?
- | | |
|------------|-------------|
| (1) Uranus | (2)* Mars |
| (3) Venus | (4) Jupiter |
- 43.** Stars which can be seen all times and all night are called
- | | |
|---------------------|------------------------|
| (1) evergreen stars | (2) forever stars |
| (3) ubiquitous | (4)* circumpolar stars |
- 44.** What is "...a celestial object that orbits the Sun and has a spherical shape but does not dominate its orbit?"
- | | |
|------------------|------------|
| (1) Asteroid | (2) Comet |
| (3)*Dwarf Planet | (4) Meteor |
- 45.** What two components describe a Red Giant star compared to other types of stars?
- Big and Hot
 - Small and Hot
 - *Big and Cold
 - Small and Cold
- 46.** This forms when the core of the star is "swallowed" by its own gravity.
- *Black Hole
 - Red Giant
 - Nebula
 - Neutron Star
- 47.** Where are stars born?
- *Nebula
 - Black Hole
 - Supernova
 - Neutron Star
- 48.** The direction that light shifts towards in the visible spectrum when a galaxy moves away Earth?
- | | |
|----------------|------------------|
| (1) Blue Shift | (2) Green Shift |
| (3)*Red Shift | (4) Yellow Shift |

- 49.** What type of star forms after a Supernova explosion?
In this star, the centre collapses so that protons and electrons combine to form neutrons. The star is so very, very dense that one teaspoon on Earth would weigh 1 billion tons.
- (1) Red Super Giant (2) Red Giant
(3) Nebula (4)* Neutron Star
- 50.** You look up and see a blue-coloured star. Which temperature best represents the temperature of the star you are seeing?
- (1) 3,000°C (2) 7,000°C
(3) 10,000°C (4)* 25,000°C
- 51.** It is the brightness of stars in the night sky as they appear from Earth.
- (1) Luminosity (2)* Apparent Magnitude
(3) Solar Mass (4) Absolute Magnitude
- 52.** It is the gleaming, white halo that surrounds a sun and extends millions of kilometres into space.
- (1) Photosphere (2)* Corona
(3) Solar Flare (4) Convective Zone
- 53.** The star Proxima Centauri is 4.01×10^{13} km from Earth. If 1 Light Year is 9.46×10^{12} km, what is the distance to Proxima Centauri in Light Years?
- (1)*4.24 Light Years
(2) 30.64 Light Years
(3) 49.56 Light Years
(4) 13.47 Light Years
- 54.** During the lifetime of a star, why does a star become very large and red?
- (1)*It is running out of hydrogen fuel
(2) Its core is expanding
(3) It is experiencing uncontrolled nuclear reactions in its core
(4) It is reaching 25,000°C on its edge
- 55.** What is "...the apparent looping motion of a planet in the night sky so the planet appears to move east to west rather than its normal west to east motion?"
- (1) Gravitational Force
(2) Celestial Sphere
(3)*Retrograde Motion
(4) Azimuth and Altitude
- 56.** Our Universe consists of only about 4% atoms. How much of it is Dark Matter and Dark Energy?
- (1) 80% Dark Matter, 16% Dark Energy
(2)*74% Dark Energy, 22% Dark Matter
(3) 94% Dark Energy, 2% Dark Matter
(4) 90% Dark Energy, 4% Dark Matter
- 57.** Star life phases that can occur during a massive star's life (100x the sun), after the supernova.
- (1)*Black Hole and Neutron Star
(2) Black Hole and White Dwarf
(3) White Dwarf and Red Supergiant
(4) Red Supergiant and Big Bang
- 58.** Astronomers have decided that, rather than being a planet, Pluto is really just a large member of the
- (1) Asteroid belt
(2)*Kuiper belt
(3) Oort cloud
(4) Moon system around Neptune
- 59.** At 10 million light years galaxies visible are the
- (1) Comet
(2) Debris
(3) Andromeda galaxy
(4)*Local group
- 60.** Based on the frequency with which we see comets from Earth, astronomers estimate the total number of comets in the solar system to be
- (1) 1 billion (2) 10 billion
(3) 100 billion (4)* 1 trillion

* denotes answer.



END OF THE EXAM