6th International Olympiad of Science

Presented by SILVER ZONE ISO 9001: 2000 Certified

Organized by Society of Science Education New Delhi, India

SILVER ZONE FOUNDATION

# Question Paper

**CLASS - 11** Duration : 60 Minutes Total Questions : 40 Maximum Marks :100

**SCIENCE** **1st Level**

iOS Roll Number

Student's Name

**TEST PAPER TYPE**
**AA**

## INSTRUCTIONS

1. Write your 12 digit iOS roll number and your name on top of the question paper in the given space.
2. Filling up improper roll number may lead to unavailability of 'Result'.
3. This question paper consist of 40 questions. Each question carries equal marking of 2.5 marks each.
4. This paper is divided into 4 sections. Section A and B are compulsory for all the candidates. However section C and D are to be answered by the candidates as per their choice of subject, i.e. either Mathematics or Biology.
5. Mark your answer (A, B, C, D or E) on the Answer Sheet with Pencil or Black/Blue Ball point Pen.
6. This question paper contains 5 pages.
7. Do not start attempting the test paper until you are asked to do so.
8. Time taken by individual student to complete the paper will be one of the criteria for tie-breaker, if any.

**Note: Return this question paper along with answer sheet**

## SECTION - A | PHYSICS

**1. A person dropped a stone from the top of a tower of height H which strikes on an inclined plane at a height h above the ground. Due to this impact, the velocity of the stone becomes horizontal. The stone will take the maximum time to reach the ground if:**

(A) $h = \frac{H}{3\sqrt{2}}$ (B) $h = \frac{H}{\sqrt{2}}$

(C) $h = \frac{H}{4}$ (D) $h = \frac{H}{2}$

(E) None of these

**2. A body weighs W newton on the surface of the earth. What will be its weight at the height equal to half the radius of the earth ?**

(A) $\frac{2W}{3}$ (B) $\frac{4W}{9}$

(C) $\frac{4W}{3}$ (D) $\frac{W}{3}$

(E) None of these

**3. A bus moving at a speed $v$ is stopped by a retarding force F in a distance s. If the speed of the bus were $3v$, the force needed to stop it within the same distance will be:**

(A) 6 F (B) 9 F

(C) 15 F (D) 18 F

(E) None of these

**4. Which one of the following is the dimension of stress?**

(A) $ML^{-1}T^{-2}$ (B) $MLT^{-2}$

(C) $ML^{2}T^{-2}$ (D) $MLT^{-3}$

(E) None of these

**5. Find the ratio $C_p/C_v$ of a gas, if the gas has *f* degree of freedom.**

(A) $\frac{3+f}{2}$ (B) $1+\frac{2f}{2}$

(C) $\frac{1}{2}+f$ (D) $1+\frac{2}{f}$

(E) None of these

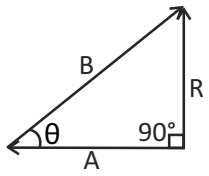
**6. A gas does 4.5 J of external work during adiabatic expansion. What will be its internal energy, if its temperature falls by 2K?**

(A) decrease by 4.5 J
(B) decrease by 3.5 J
(C) increase by 4.5 J
(D) increase by 3.5 J
(E) None of these

**7. Which one of the following is correct for a body that is moving in a circular path with constant speed?**

(A) Constant velocity
(B) Constant acceleration
(C) Constant displacement
(D) Constant kinetic energy
(E) None of these

**8. In vector diagram, shown in the given figure, R is the resultant of vectors A and B. If R = $\frac{B}{\sqrt{2}}$, find the of value of angle $\theta$.**




(A) 15° (B) 45°
(C) 60° (D) 75°
(E) None of these

**9. If pressure of an ideal gas in a closed container is increased by 2%, the temperature of the gas is increased by 5°C. Find the initial temperature of the gas.**

(A) 150 K (B) 225 K
(C) 250 K (D) 300 K
(E) None of these

**10. An object A is projected vertically upwards. Another object B of the same mass is projected at an angle of 60° with the horizontal. If both attain the same maximum height, the ratio of the initial kinetic energy of A to that of B is:**

(A) $\frac{3}{4}$ (B) $\frac{\sqrt{2}}{3}$
(C) $\frac{1}{\sqrt{3}}$ (D) $\frac{1}{2}$
(E) None of these

**11. A ball is released from a height equal to the radius (R) of the earth. What will be the velocity of the ball when it strikes the surface of the earth?**

(A) $\sqrt{gR}$ (B) $\sqrt{3gR}$
(C) $3\sqrt{2gR}$ (D) $2\sqrt{gR}$
(E) None of these

**12. An object is thrown vertically up with a velocity u. It passes three points A, B and C in its upward journey with velocities $\frac{u}{2}$, $\frac{u}{3}$ and $\frac{u}{4}$ respectively. The ratio $\frac{AB}{BC}$ is:**

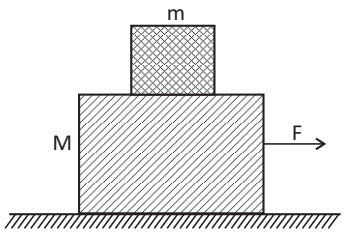
(A) $\frac{13}{7}$ (B) $\frac{15}{7}$
(C) $\frac{18}{7}$ (D) $\frac{20}{7}$
(E) None of these

**13. A train standing at a certain distance from a railway platform is blowing a whistle of frequency 500 Hz. If the speed of sound is 340 $ms^{-1}$, the frequency and wavelength of the sound of the whistle heard by a man running towards the engine with a speed of 10 $ms^{-1}$ respectively are:**

(A) 500 Hz, 0.7 m (B) 500 Hz, 0.68 m
(C) 486 Hz, 0.7 m (D) 515 Hz, 0.68 m
(E) None of these

**14. In the given figure, two blocks of masses M = 5 kg and m = 3 kg are placed on a horizontal surface. The coefficient of friction between the blocks is 0.5 and that between the block M and the horizontal surface is 0.7. What is the maximum horizontal force F that can be applied to block M so that the two blocks move without slipping?**

**Take g = 10 $ms^{-2}$.**




(A) 96 N (B) 48 N
(C) 24 N (D) 30 N
(E) None of these

**15. If a mass m is hung from the lower end of a spring of negligible mass, an extension L is produced in the spring. The mass is set into vertical oscillations. The time period of oscillation is:**

(A) $T = \pi\sqrt{\frac{L}{mg}}$ (B) $T = 3\pi\sqrt{\frac{gL}{m}}$

(C) $T = 2\pi\sqrt{\frac{L}{g}}$ (D) $T = 2\pi\sqrt{\frac{L}{2g}}$

(E) None of these

## SECTION - B | CHEMISTRY

**16. The equivalent mass of $MnSO_4$ is half of its molar mass when it is converted to:**

(A) $MnO_2$
(B) $Mn_2O_3$
(C) $MnO_4^-$
(D) $MnO_4^{2-}$
(E) None of these

**17. Which one of the following has maximum number of atoms?**

(A) 24 g of C ($M = 12\ g\ mol^{-1}$)
(B) 23 g of Na ($M = 23\ g\ mol^{-1}$)
(C) 48 g of S ($M = 32\ g\ mol^{-1}$)
(D) 108 g of Ag ($M = 108\ g\ mol^{-1}$)
(E) None of these

**18. When an electron jumps from n = 6 to n = 2 levels in hydrogen atom, the obtained spectral line belongs to the:**

(A) Balmer series
(B) Lyman series
(C) Paschen series
(D) Pfund series
(E) None of these

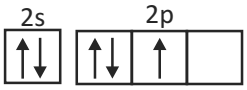
**19. Which one of the following is produced on passing $H_2S$ gas through nitric acid?**

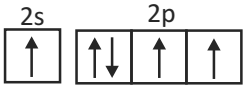
(A) Rhombic sulphur
(B) Monoclinic sulphur
(C) Plastic sulphur
(D) Amorphous sulphur
(E) None of these

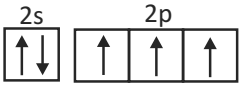
**20. Which one of the following carbides represents carborundum?**

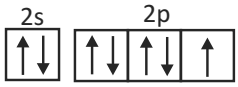
(A) $B_4C_3$
(B) SiC
(C) TiC
(D) MoC
(E) None of these

**21. In which one of the following orbital diagrams aufbau principle is violated?**

(A) 


(B) 


(C) 


(D) 


(E) None of these

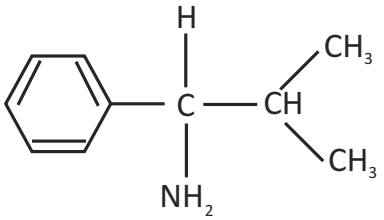
**22. The root mean square speeds of gaseous molecules changes with change in the:**

(A) Pressure of the gas
(B) Temperature of the gas
(C) Volume of the gas
(D) Density of the gas
(E) None of these

**23. Which one of the following oxides gives hydrogen peroxide on treatment with a dilute acid ?**

(A) $Na_2O_2$
(B) $PbO_2$
(C) $MnO_2$
(D) $TiO_2$
(E) None of these

**24. What is the IUPAC name of the given compound?**

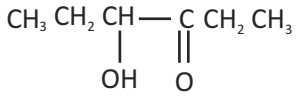


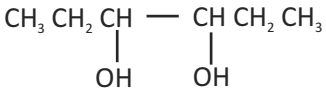

(A) 1- amino-2-methyl-1-phenylpropane
(B) 1- amino-1-phenyl-2-methylpropane
(C) 2- methyl-1-amino-1-phenylpropane
(D) 1- isopropyl-1-phenylmethyl-2-amine
(E) None of these

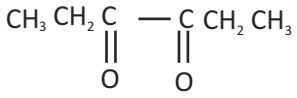
**25. Bromination of n-butane produces:**

(A) 2-bromobutane as the major product
(B) 1-bromobutane as the major product
(C) both 1-bromo and 2-bromo products with equal percentages
(D) both 1-bromo and 2-bromo products whose percentages depend upon temperature
(E) None of these

**26. What do we get on treatment of $CH_3CH_2C \equiv CCH_2CH_3$ with $KMnO_4$ in alkaline or acidic conditions at higher temperatures?**

(A) 

(B) 

(C) 

(D) $CH_3CH_2COOH$

(E) None of these

**27. Which one of the following is the correct order of increasing stability of the given alkenes?**

(A) 1-pentene > trans-pentene > cis-pentene > 2-methyl-2-butene

(B) 1-pentene > cis-pentene > trans-pentene > 2-methyl-2-butene

(C) 1-pentene < cis-pentene < trans-pentene < 2-methyl-2-butene

(D) 1-pentene < trans-pentene < cis-pentene < 2-methyl-2-butene

(E) None of these

**28. Which one of the following statements is not correct?**

(A) $NH_3$ is a stronger base than $PH_3$

(B) $SH^-$ is a weaker base than $OH^-$

(C) $CH_3SO_3^-$ is a stronger base than $CH_3SeO_3^-$

(D) $CH_3COO^-$ is a weaker base than $CH_3O^-$

(E) None of these

**29. Which one of the following characteristics about phosphorus is correct?**

(A) Both white and red phosphorus are inactive

(B) Both white and red phosphorus are reactive

(C) White phosphorus is reactive whereas red phosphorus is inactive

(D) White phosphorus is much less reactive than red phosphorus

(E) None of these

**30. Which one of the following is the correct expression of radius of a Bohr orbit in a hydrogen-like species?**

(A) $r = 2n^2\left[\dfrac{4\pi^2 m(Ze^2/4\pi\varepsilon_0)}{h^2}\right]$

(B) $r = \dfrac{1}{n^2}\left[\dfrac{4\pi^2 m(Ze^2/4\pi\varepsilon_0)}{h^2}\right]$

(C) $r = n^2\left[\dfrac{h^2}{4\pi^2 m(Ze^2/4\pi\varepsilon_0)}\right]$

(D) $r = \dfrac{1}{n^2}\left[\dfrac{h^2}{4\pi^2 m(Ze^2/4\pi\varepsilon_0)}\right]$

(E) None of these

## SECTION - C | MATHEMATICS

**31. $6^{th}$ term in expansion of $\left(2x^2 - \dfrac{1}{3x^2}\right)^{10}$ is:**

(A) $\dfrac{4580}{17}$ (B) $\dfrac{6580}{17}$

(C) $\dfrac{5580}{17}$ (D) $-\dfrac{896}{27}$

(E) None of these

**32. If $2 + i\sqrt{3}$ is a root of the equation $x^2 + px + q = 0$, where p and q are real, then (p,q)=**

(A) (–4,–7) (B) (4,–7)

(C) (4,7) (D) (–4,7)

(E) None of these

**33. $\sqrt{-2}\,\sqrt{-3}$ =**

(A) $\sqrt{6}$ (B) $-6$

(C) $i\sqrt{6}$ (D) $-\sqrt{6}$

(E) None of these

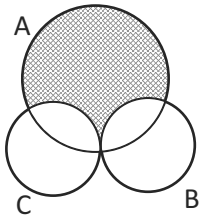
**34. The latus rectum of an ellipse be equal to half of its minor axis, then its eccentricity is:**

(A) $\dfrac{3}{2}$ (B) $\dfrac{2}{3}$

(C) $\dfrac{\sqrt{3}}{2}$ (D) $\dfrac{\sqrt{2}}{3}$

(E) None of these

**35. The shaded region in the given figure is:**



(A) $A \cap (B \cup C)$ (B) $A \cup (B \cap C)$
(C) $A \cap (B - C)$ (D) $A - (B \cup C)$
(E) None of these

**36. If x, 2x + 2, 3x + 3, are in G.P., then the fourth term is:**
(A) 27 (B) –27
(C) 13.5 (D) –13.5
(E) None of these

**37. Find the area of the parallelogram formed by the pair of lines $2x^2 + 5xy + 3y^2 = 0$ and $2x^2 + 5xy + 3y^2 + 3x + 4y + 1 = 0$.**
(A) 8 units (B) 4 units
(C) 2 units (D) 1 units
(E) None of these

**38. The angle between the two lines y –2x = 9 and x + 2y = –7, is:**
(A) 60° (B) 90°
(C) 30° (D) 45°
(E) None of these

**39. A coin is tossed 3 times. The probability of getting exactly two heads is:**
(A) $\frac{1}{2}$ (B) $\frac{3}{8}$
(C) $\frac{1}{4}$ (D) $\frac{5}{8}$
(E) None of these

**40. If the letters of the word SACHIN arranged in all possible ways and these words are written out as in dictionary, then the word SACHIN appears at serial number**
(A) 603 (B) 602
(C) 600 (D) 601
(E) None of these

## SECTION - D | BIOLOGY

**31. Invertebrate, exoskeleton, segmented body and jointed appendages are the characteristic features of:**
(A) Platyhelminthes (B) Nematodes
(C) Annelids (D) Arthropods
(E) None of these

**32. Which one of the following animals has a single circulation system?**
(A) Bird (B) Frog
(C) Crocodile (D) Fish
(E) None of these

**33. An earthworm belongs to which one of the following phyla?**
(A) Nematoda (B) Mollusca
(C) Arthropoda (D) Annelida
(E) None of these

**34. Which one of the following simple permanent tissues does not have closely packed cells?**
(A) Sclerenchyma (B) Collenchyma
(C) Parenchyma (D) All of these
(E) None of these

**35. Bile is a greenish yellow liquid secreted by the liver. It is normally stored in the:**
(A) Pancreas (B) Esophagus
(C) Small intestine (D) Gall bladder
(E) None of these

**36. In respiration, the oxidation of glucose to pyruvic acid takes place in which one of the following parts of cell?**
(A) Nucleus (B) Mitochondria
(C) Ribosome (D) Cytoplasm
(E) None of these

**37. Which one of the following brings blood into the kidney for filtration?**
(A) Renal vein (B) Glomerulus
(C) Renal artery (D) Ureter
(E) None of these

**38. The growth of plant parts towards or away from water is called:**
(A) Phototropism (B) Hydrotropism
(C) Thigmotropism (D) Chemotropism
(E) None of these

**39. Which one of the following is the centre of vision?**
(A) Olfactory lobes
(B) Optic lobes
(C) Cerebral cortex
(D) Medulla oblongata
(E) None of these

**40. Which one of the following statements is correct about the Golgi apparatus?**
(A) Golgi apparatus helps in the secretion of mucus, enzyme and hormones
(B) Golgi apparatus helps in the storage, modification, and packaging of secretory products in the vesicles
(C) Golgi apparatus helps in the formation of lysosomes
(D) All of these
(E) None of these