CLASS
12th

*i*OS'13
International Olympiad of
Science

Organized by Society of Science Education, New Delhi, India

SILVER ZONE FOUNDATION

QUESTION PAPER

TEST PAPER TYPE

DD

Duration : 60 Minutes

Maximum Marks : 100

LEVEL 1

Enrollment No.

Student Name

School Name

Read the following instructions carefully before you begin to answer the questions in the OMR Answer Sheets provided along with this question paper. Ask the Examination In-charge/Invigilator how to mark the OMR Answer Sheets, in case you have any doubts.

INSTRUCTION TO CANDIDATES TO BE EXPLAINED BY THE INVIGILATORS

1. This Booklet contains 40 questions. All questions carry an equal marks of 2.5 each.
2. All questions are compulsory.
3. The paper is divided into 4 sections. Section A and B is compulsory for all the candidates. However section C and D is to be answered by the candidates as per their choice of subject, i.e. either Mathematics or Biology.
4. This Booklet contains 6 pages. Please check, if any page is misprintied, missing or repeated.
5. Collect your OMR Answer Sheets from the Invigilator/Examination In-Charge to answer the questions given in this Booklet.
6. You must fill all the necessary information's which are required in the space provided in this booklet and OMR Answer Sheet.
7. Correct Answers must be marked by **"Darkening"** the corresponding circles on the OMR Answer Sheet, against the relevant question number with **Pencil** or **Blue/Black, Ball point Pen** only. Answers which are not darkened in circle will not be awarded with any mark.
8. Space for rough work is provided in this booklet. No rough work is to be done in the OMR Answer Sheet.
9. Mobile Phones and other Wireless equipments are banned in the examination halls/rooms.
10. OMR Answer Sheets must be handed over to the Examination In-charge/Invigilator before you leave the examination room/hall and recheck that you have filled all the required informations.
11. The results will be published in our web-site WWW.SILVERZONE.ORG in the month of Jan 2014. You can check it with your 12 digit Roll Number provided in the Enrollment Ticket.

TEACHERS ARE REQUESTED TO CHECK IF THE REQUIRED INFORMATIONS ARE PROPERLY FILLED BY THE CANDIDATES IN THE QUESTION PAPER & OMR ANSWER SHEETS, AND ALSO ENSURE THAT OMR ANSWER SHEETS ARE PROPERLY MARKED. PLEASE SEND US BACK THE OMR ANSWER SHEETS ONLY.

Note: Return this question paper along with answer sheet

SECTION - A : PHYSICS

1. A metallic sphere A of radius r_1 carries a charge Q. It is brought in contact with an uncharged sphere B of radius r_2. The charge on sphare A now will be

(A) $\dfrac{r_1 Q}{r_2}$ (B) $\dfrac{r_2 Q}{r_1}$

(C) $\dfrac{r_2 Q}{r_1 + r_2}$ (D) $\dfrac{r_1 Q}{r_1 + r_2}$

(E) None of these

2. An electric dipole placed with its axis inclined at an angle to the direction of a uniform electric field experiences:
(A) A force but no torque
(B) A torque but no force
(C) A force as well as a torque
(D) Neither a force nor a torque
(E) None of these

3. Three charges, each of magnitude $q = 2\mu C$ are placed at the vertices, P, Q and R of the triangle as shown in figure given below. The sum of the sides PQ and PR is 12 cm and their product is 32 cm². The potential at point P would be
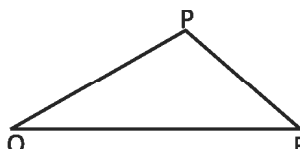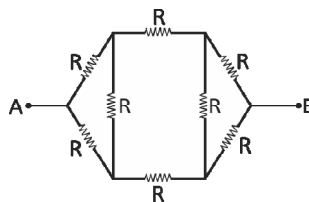

(A) 6.00×10^5 V (B) 6.25×10^5 V
(C) 6.50×10^5 V (D) 6.75×10^5 V
(E) None of these

4. The following figure shows a network of capacitors where $C_1 = C_2 = C_3 = C_4 = 4\mu F$ and $C_5 = 5\mu F$. The equivalent capacitance between points A and B is:
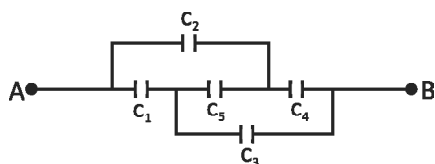
(A) $4\mu F$ (B) $5\mu F$
(C) $16\mu F$ (D) $20\mu F$
(E) None of these

**5.** In the circuit shown in the following figure, the equivalent resistance between points A and B is:

(A) $\dfrac{3R}{4}$ (B) $\dfrac{5R}{6}$

(C) $\dfrac{7R}{10}$ (D) $\dfrac{11R}{9}$

(E) None of these

6. A transformer is used for
(A) Converting mechanical energy into electrical energy
(B) Increasing or decreasing a d.c. voltage
(C) Converting an a.c. voltage into a d.c. voltage
(D) Increasing or decreasing an a.c. voltage
(E) None of these

7. A carbon nucleus emits a particle x and changes into nitrogen according to the equation

$$^{14}_{6}C \rightarrow \,^{14}_{7}N + x$$
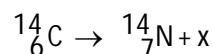
What is x?
(A) An electron (B) A proton
(C) An alpha particle (D) A photon
(E) None of these

8. A current carrying wire AB is placed near another CD as shown in figure. Wire CD is fixed while wire AB is free to move. When a current is passed through wire AB, it will have
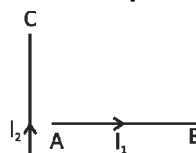
(A) Only translational motion
(B) Only rotational motion
(C) Both translational as well as rotational motions
(D) Neither translational nor rotational motion
(E) None of these

9. **A coil of metal wire is kept stationary in a non-uniform magnetic field,**
   (A) An emf and current are both induced in the coil
   (B) A current but no emf is induced in the coil
   (C) An emf but no current is induced in the coil
   (D) Neither emf nor current is induced in the coil
   (E) None of these

10. **A lens of power + 2.0 D is placed in contact with another lens of power – 1.0 D. The combination will behave like**
   (A) A converging lens of focal length 100 cm
   (B) A diverging lens of focal length 100 cm
   (C) A converging lens of focal length 50 cm
   (D) A diverging lens of focal length 50 cm
   (E) None of these

11. **When a glass prism of refracting angle 60° is immersed in a liquid, its angle of minimum deviation is 30°. The critical angle of glass with respect to the liquid medium is:**
   (A) 42°   (B) 45°
   (C) 50°   (D) 52°
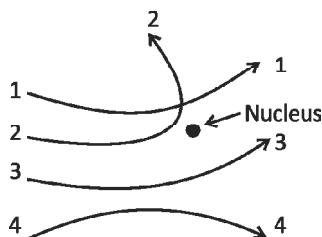   (E) None of these

12. **Monochromatic light of wavelength λ in air is refracted into a glass slab of refractive index μ. The wavelength of light in glass is:**
   (A) λ (B) $\mu\lambda$
   (C) $\dfrac{\lambda}{\mu}$ (D) $\dfrac{\lambda}{\mu^2}$
   (E) None of these

13. **The magnetic field at the nucleus of a hydrogen atom due to the motion of an electron in the nth orbit is inversely proportional to:**
   (A) n^2 (B) n^3
   (C) n^4 (D) n^5
   (E) None of these

14. **Alpha particles are fired at a nucleus. Which of the paths shown in figure is not possible?**

   (A) 1   (B) 2
   (C) 3   (D) 4
   (E) None of these

15. **Choose the wrong statement. A thermonuclear fusion reactor is better than a fission reactor for the following reasons:**
   (A) For the same mass of substances involved, a fusion reaction releases much more energy than a fission reaction
   (B) A fusion reaction can be much more easily controlled than a fission reaction
   (C) A fusion reaction produces almost no radioactive waste
   (D) The fuel required for fusion is readily available in abundance from sea-water
   (E) None of these

SECTION - B : CHEMISTRY

16. **In the chemical reaction, $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$, the pressure of $CO_2(g)$ depends on:**
   (A) The mass of $CaCO_3(s)$
   (B) Temperature of the system
   (C) The masses of both $CaCO_3(s)$ and $CaO(s)$
   (D) The mass of $CaO(s)$
   (E) None of these

17. **Which of the following statements is incorrect about order of a reaction?**
   (A) Order of a reaction can never be equal to zero or fractional value
   (B) It is always determined experimentally
   (C) It is equal to the molecularity of an elementary reaction
   (D) It is sum of the powers of concentration terms in the differential rate law of a reaction
   (E) None of these

18. **An isotope of the parent element is produced with the emission of:**
   (A) One α- and one β-particle
   (B) One α- and two β-particles
   (C) Two α- and one β-particles
   (D) Two α- and two β-particles
   (E) None of these

19. The chemical processes in the production of steel from haematite ore involve

(A) Reduction

(B) Oxidation

(C) Reduction followed by oxidation

(D) Oxidation followed by reduction

(E) None of these

20. Which of the following is expected to have the lowest boiling point?

(A) CH_3CH_2OH (B) CH_3CHO

(C) CH_3COOH (D) CH_3OCH_3

(E) None of these

21. A new carbon-carbon bond formation is possible in:

(A) Cannizzaro reaction

(B) Friedel-Carfts alkylation

(C) Reimer-Tiemann reaction

(D) Both (B) and (C)

(E) None of these

22. Which of the following reagents can convert benzenediazonium chloride into benzene?

(A) Water

(B) Acid

(C) Hypophosphorous acid

(D) HCl

(E) None of these

23. The molecular formula of Glauber's salt is:

(A) $MgSO_4 . 7H_2O$

(B) $Na_2O_2 . 5H_2O$

(C) $FeSO_4 . 7H_2O$

(D) $Na_2SO_4 . 10H_2O$

(E) None of these

24. The half-life of a radioactive isotope is 3 h. What mass out of 100 g is left after 15 h?

(A) 12.5 g   (B) 6.25 g

(C) 3.125 g   (D) 1.562 g

(E) None of these

25. The vapour-pressure lowering of a solvent is proportional to

(A) The mole fraction of the solute

(B) The mole fraction of the solvent

(C) The molality of the solvent

(D) The normality of the solution

(E) None of these

26. The rate constant of a reaction depends on

(A) Temperature

(B) Initial concentration of the reactants

(C) Time of reaction

(D) Extent of reaction

(E) None of these

27. Physical adsorption

(A) Involves the weak attractive interactions between the adsorbent and adsorbate

(B) Involves the chemical interactions between the adsorbent and adsorbate

(C) Is irreversible in nature

(D) Increases with increase in temperature

(E) None of these

28. A colloidal solution can be purified following the method of

(A) Dialysis

(B) Peptization

(C) Filtration

(D) Oxidation

(E) None of these

29. Starch is a polymer of:

(A) Glucose

(B) Fructose

(C) Sucrose

(D) Ribose

(E) None of these

30. The correct acidity order of the compounds
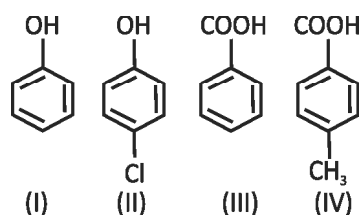
(A) (III) > (IV) > (II) > (I)

(B) (IV) > (III) > (I) > (II)

(C) (III) > (II) > (I) > (IV)

(D) (II) > (III) > (IV) > (I)

(E) None of these

SECTION - C : MATHEMATICS

31. Consider the following relation:

(1) $A - B = A - (A \cap B)$

(2) $A = (A \cap B) \cup (A - B)$

(3) $A - (B \cap C) = (A - B) \cup (A - C)$

Which of these is/are correct:

(A) 1 and 3   (B) 2 only

(C) 2 and 3   (D) 1 and 2

(E) None of these

32. The value of $\{\sin^{-1}(\sin\frac{5\pi}{6})\}$ is:

(A) $\dfrac{\pi}{6}$ (B) $\dfrac{2\pi}{3}$

(C) $\dfrac{5\pi}{6}$ (D) $\dfrac{6\pi}{3}$

(E) None of these

33. If A and B are two matrices such that $AB = B$ and $BA = A$, then $A^2 + B^2$ is equal to

(A) $A + B$ (B) $2\,BA$

(C) $2\,AB$ (D) AB

(E) None of these

34. Find $\dfrac{dy}{dx}$, when $y = \dfrac{e^x + e^{-x}}{e^x - e^{-x}}$

(A) $\dfrac{8}{\left(e^x - e^{-x}\right)^2}$ (B) $\dfrac{2}{\left(e^x + e^{-x}\right)^2}$

(C) $\dfrac{-4}{\left(e^x - e^{-x}\right)^2}$ (D) $\dfrac{-2}{\left(e^x - e^{-x}\right)^2}$

(E) None of these

35. The equation of the normal to the curve $y = \sin\dfrac{\pi x}{2}$ at (1, 1) is:

(A) $x = 1$ (B) $y = 1$

(C) $y = x$ (D) $y - 1 = \dfrac{-2}{\pi}$

(E) None of these

36. $\displaystyle\int x \sin^2 x\, dx =$

(A) $\dfrac{x^2}{4} + \dfrac{x}{4}\sin 2x + \dfrac{1}{8}\cos 2x + C$

(B) $\dfrac{x^2}{4} - \dfrac{x}{4}\sin 2x + \dfrac{1}{8}\cos 2x + C$

(C) $\dfrac{x^2}{4} + \dfrac{x}{4}\sin 2x - \dfrac{1}{8}\cos 2x + C$

(D) $\dfrac{x^2}{4} - \dfrac{x}{4}\sin 2x - \dfrac{1}{8}\cos 2x + C$

(E) None of these

37. $\displaystyle\int_0^{2\pi} \sqrt{1 + \sin\dfrac{x}{2}}\, dx =$

(A) 0   (B) 2

(C) 8   (D) 4

(E) None of these

38. If $y = A\cos nx + B\sin nx$, than $\dfrac{d^2y}{dx^2} =$

(A) $-n^2 y$ (B) $-y$

(C) $n^2 y$ (D) x

(E) None of these

39. If the events A and B are mutually exclusive, than $P\left(\dfrac{A}{B}\right) =$

(A) $\dfrac{P(A \cap B)}{P(B)}$ (B) 1

(C) $\dfrac{P(A \cap B)}{P(A)}$ (D) 0

(E) None of these

40. If $^nP_5 = 9 \times {}^{n-1}P_4$, than the value of n is:

(A) 6   (B) 8

(C) 9   (D) 5

(E) None of these

31. Fusion of dissimilar gametes is known as:
(A) Fertilization   (B) Dichogamy
(C) Autogamy   (D) Allogamy
(E) None of these

32. Fertilization in earthworm occurs in:
(A) Cocoon   (B) Spermathecae
(C) Coelom   (D) Seminal vesicles
(E) None of these

33. What do you mean by the term spermitogenesis?
(A) Conversion of spermatids to sperm
(B) Conversion of spermogonium to spermatid
(C) Conversion of spermatid to spermogonium
(D) Conversion of primary spermatocyte to secondary spermatocyte
(E) None of these

34. Tunica albuginea is the covering of:
(A) Liver   (B) Spleen
(C) Testis   (D) Lungs
(E) None of these

35. The transfer of genetic material from one bacterium to another by virus is called:
(A) Transduction   (B) Translation
(C) Conjugation   (D) Transformation
(E) None of these

36. The maximum formation of m-RNA occurs in:
(A) Cytoplasm   (B) Nucleolus
(C) Ribosome   (D) Nucleoplasm
(E) None of these

37. If the DNA codons are ATG ATG ATG and a cytosine base is inserted at the beginning then which one of the following will result in m-RNA?
(A) CATG ATG ATG   (B) CA TGA TGA TG
(C) CAT GAT GATG   (D) GUA CUA CUAC
(E) None of these

38. The exaggerated response of the immune system to certain antigens present in the environment is called:
(A) Allergy
(B) Immunity
(C) Auto-immune
(D) Passive immunization
(E) None of these

39. Transformation of normal cells into cancerous neoplastic cells may be induced by:
(A) Physical agent
(B) Chemical agent
(C) Biological agent
(D) All of these
(E) None of these

40. Individual of a species which occurs in a particular area constitute:
(A) Flora   (B) Fauna
(C) Population   (D) Flora and fauna
(E) None of these

Space for Rough Work