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Level - 1 : All Level-1 successful* participants will get certificate, aptitude report and online subscription, and school toppers will be eligible for school hero medals.

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* # See prospectus/website for details

1. You are allowed additional 10 minutes to fill the required details in the **RESPONSE SHEET (OMR)**.
2. The question paper is made as per syllabus guidelines & pattern given in the information Booklet. The Question Paper for Classes 1 to 6 contains 25 Questions each to be answered in 40 minutes. The Question paper for classes 7 to 12 contains 50 Questions each to be answered in 60 minutes. All questions are compulsory. Further instructions are given in the instruction letter to the teacher.
3. Use the response sheet to mark your responses by darkening the required circle. The response sheet has to be returned to the foundation, duly filled in. **THE STUDENT CAN RETAIN THE QUESTION PAPER.**

**NATIONAL
BIOTECHNOLOGY
OLYMPIAD**

N B T O

**12
Class**

**A1
Paper
Code**

L E V E L - 1

GENERAL KNOWLEDGE

1. Which of the following concepts can be used to study the rate of acceleration of the Universe?

I. Supernovae Explosions.

II. Dark Matter.

III. Dark Energy.

IV. Black Holes.

- (1) I & III only (2) I & II only
(3) I, III & IV only (4) None of these

2. Which of the following statements is/are correct:

I. Ozone Depletion causes reduction in stratospheric and upper tropospheric temperatures.

II. Increase in Green House Gases causes reduction in stratospheric and upper tropospheric temperatures.

- (1) I only
(2) II only
(3) Both I and II
(4) None of these

3. The Basel Convention on the Control of Trans boundary Movements of Hazardous Wastes and Their Disposal, usually known as the Basel Convention:

I. It is an international treaty that was designed to reduce the movements of hazardous wastes from developed to less developed countries.

II. It does not address the movement of radioactive waste.

- (1) I only (2) II only
(3) Both I and II (4) None of these

4. Recently Chinese scientists have developed Carbon Aerogel. Which of the following is/are correct about it:

- I. It is the second lightest material after Graphite aerogel.
- II. It has excellent elasticity.
- III. It is expected to play an important role in pollution control.
- 4. It is expected to become ideal material for sound absorption.

- (1) II, III & IV only (2) II & IV only
 (3) I & III only (4) None of these

5. Which of the following statements is/are correct with regard to mobile touch screen technology?

- I. When a user touches a capacitive touch screen some charge is transferred to the user from the screen.
- II. Capacitive touch screen technology has more life than resistive touch screen technology.
- III. Capacitive screens provide clearer image than resistive screens.

- (1) I, II & III (2) I only
 (3) I & III only (4) None of these

6. A student hypothesizes that green algae will grow fastest when exposed to blue light. To test this hypothesis, the student should design an experiment with which independent variable?

- (1) Color of algae
- (2) Rate of algae growth
- (3) Color of light that algae are exposed to
- (4) None of these

7. "World Cancer Day" is observed on _____ .

- (1) 22nd Feb (2) 28th Feb
 (3) 4th Feb (4) None of these

8. Due to its ability to dissolve glass, which acid is not kept in glass container?

- (1) Nitric Acid (2) Sulphuric Acid
 (3) Hydrofluoric Acid (4) None of these

9. To produce artificial rains, which chemical is used for Cloud Seeding ?

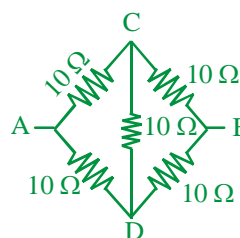
- (1) Copper Sulphate (2) Ammonium Nitrate
 (3) Silver Iodide (4) None of these

10. What is the common name of Indian national tree 'Ficus Bengalensis' ?

- (1) Neem (2) Peepal
 (3) Bargad (Banyan) (4) None of these

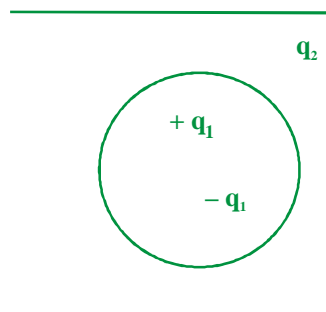
SECTION B: PHYSICS AND CHEMISTRY

11. The equivalent resistance between A and B in the given circuit is



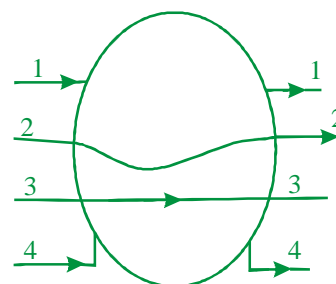
- (1) 10 Ω (2) 30 Ω
 (3) 20 Ω (4) None of these

12. Consider the charge configuration and spherical Gaussian Surface as shown in the figure. When calculating the flux of the electric field over the spherical surface, the electric field will be due to



- (1) q_2
 (2) only the positive charges
 (3) all the charges
 (4) none of these

13. A metallic solid sphere is placed in an uniform electric field. The lines of force follow the path(s) shown in the figure is in



- (1) 1 (2) 2
 (3) 4 (4) None of these

14. To make an uncharged object has a negative charge, we must:

- (1) add some atoms
 (2) remove some atoms
 (3) add some electrons
 (4) none of these

15. A jet plane is flying horizontally at a speed of 1800 km/hour .What is the potential difference developed between the tips of its wings if the wing span is 25 m? Earth's magnetic field at the location is 0.4 gauss and the angle of dip is 30° .

- (1) 25 mV (2) 250 mV
 (3) 500 mV (4) None of these

16. A source of light is passed through isolated chlorophyll solution. When source is removed , which light is emitted by solution?

- (1) Same as source of light
 (2) No light is emitted
 (3) Green
 (4) None of these

17. The rates of transfer of molecules from ice into water and of reverse transfer from water into ice are equal at atmospheric pressure and 273 K. Both the processes occur simultaneously and at the same rate so that the amount of ice and water remains constant. This process is called

- (1) ionic equilibrium
 (2) dynamic equilibrium
 (3) liquid-Gas Equilibrium
 (4) none of these

18. A compound is formed by Elements A and B. This crystallizes in the cubic structure where A atoms are at the corners of the cube and B atoms are at the body centres. The simplest formula of the compound is

- (1) AB (2) AB_6
 (3) A_6B (4) None of these

19. On addition of conc. H_2SO_4 to a chloride salt, colourless fumes are evolved but in case of iodide

salt, violet fumes come out. This is because

- (1) H_2SO_4 reduces HI to I_2
 (2) HI is of violet colour
 (3) HI gets oxidised to I_2
 (4) none of these

20. The largest oxidation number exhibited by an element depends on its outer electronic configuration. With which of the following outer electronic configurations the elements will exhibit largest oxidation number?

- (1) $3d^1 4s^2$
 (2) $3d^3 4s^2$
 (3) $3d^5 4s^2$
 (4) None of these

SECTION C : BIOLOGY

21. Letharia vulpine is a poisonous lichen as they secrete



- (1) vulpinic acid
 (2) letharic acid
 (3) usnic acid
 (4) none of these

22. Homo: generic name :: sapiens : _____

- (1) species name
 (2) human name
 (3) division name
 (4) none of these

23. Juicy hair like structures observed in the lemon fruit develop from

- (1) exocarp
 (2) endocarp
 (3) mesocarp
 (4) none of these

24. The commonest and smallest type of leucocyte in a healthy adult man is

- (1) monocyte (2) thrombocyte
(3) lymphocyte (4) none of these

25. The valves which allow blood to flow from the ventricles into the arteries and not in the opposite direction are

- (1) A.V. valve (Atrioventricular valve) and semilunar valve
(2) Bicuspid and tricuspid valve
(3) Semilunar valve and tricuspid valve
(4) None of these

26. People living at sea level have around 5 million RBC per cubic millimeter of their blood whereas those living at an altitude of 5400 metres have around 8 million. This is because at high altitude

- (1) There is more UV radiation which enhances RBC production
(2) Atmospheric O_2 level is less and hence more RBCs are needed to absorb the required amount of O_2 to survive
(3) People eat more nutritive food, therefore more RBCs are formed
(4) None of these

27. A certain road accident patient with unknown blood group needs immediate blood transfusion. His one doctor friend at once offers his blood. What was the blood group of the donor?

- (1) Blood group A (2) Blood group B
(3) Blood group O (4) None of these

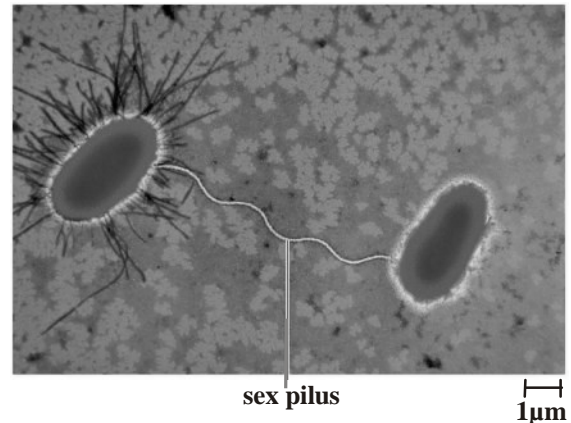
28. The hypothesis that all photosynthesis organisms require a source of hydrogen was first proposed by

- (1) Hill
(2) Hatch and Slack
(3) Van Niel
(4) None of these

29. The only sugar normally absorbed in the intestine against a concentration gradient is

- (1) Xylose (2) Mannose
(3) Glucose (4) None of these

30. The unidirectional transfer of genetic material from a donor bacterium to recipient bacterium by cell to cell contact is termed as



- (1) Transformation
(2) Recombination
(3) Conjugation
(4) None of these

31. Which one of the following experiments suggests that simplest living organisms could not have originated spontaneously from non-living matter?

- (1) Microbes did not appear in stored meat.
(2) Larva could appear in decaying organic matter.
(3) Meat was not spoiled, when heated and kept sealed in a vessel.
(4) None of these

32. A normal girl baby receives her X chromosomes from

- (1) her mother only
(2) both mother and father
(3) her father only
(4) none of these

33. **Assertion:** The earliest organisms that appeared on the earth were non-green and presumably anaerobes.

Reason: The first autotrophic organisms were the chemo-autotrophs that never released oxygen.

- (1) Both Assertion and Reason are true but the Reason is not the correct explanation of the Assertion.
(2) Both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.
(3) Assertion is true statement but the Reason is false.
(4) None of these

34. Rh factor can produce life-threatening disease

- _____.
- (1) Erythroblastosis fetalis
 - (2) Turner's Syndrome
 - (3) AIDS
 - (4) None of these

35. Grain colour in wheat is determined by three pairs of polygene. Following the cross **AABBCC** × **aabbcc**, in F₂-Generation what proportion of the progeny is likely to resemble either parent?

- (1) Less than 5 percent
- (2) One fourth
- (3) One third
- (4) None of these

36. The folding of a joint by drawing one articulating bone to the other is done by:

- (1) Pronator muscle
- (2) None of these
- (3) Extensor muscle
- (4) Flexor muscle

37. Arrange the following plants in ascending order based on the number of xylem strands in their roots:

- | | |
|--------------|---------------|
| (a) Trapa | (b) Pisum |
| (c) Castanea | (d) Nicotiana |
- (1) b,d,c,a
 - (2) a,d,b,c
 - (3) c,d,b,a
 - (4) none of these

38. Experiments demonstrating the importance of the nucleus in controlling the growth of the cell was performed in

- (1) Acetabularia
- (2) Starfish
- (3) Neurospora
- (4) None of these

39. In human, forebrain is further divided into :

- (1) Cerebrum, limbic system & thalamus
- (2) Thalamus & cerebrum
- (3) Cerebrum & limbic structure
- (4) None of these

40. DNA finger prints

- (1) As evidence for paternity
- (2) RFLPs
- (3) To diagnose viral infection
- (4) None of these

SECTION C : MATHEMATICS

21. If $f(x) = \frac{x+2}{3}$, then $f^{-1}(x) = ?$

- (1) $3x - 2$
- (2) $2x - 3$
- (3) $\frac{3}{x+2}$
- (4) none of these

22. Matrix *A* has 4 rows and 3 columns, and Matrix *B* has 5 rows and 2 columns. The Matrix *AB* will have?

- (1) 4 rows and 2 columns
- (2) 5 rows and 3 columns
- (3) 2 rows and 4 columns
- (4) none of these

23. There are 6 black, 4 red and 2 white balls in a box. A ball is drawn at random, what is the probability that the ball is red?

- (1) $\frac{1}{2}$
- (2) $\frac{1}{3}$
- (3) $\frac{1}{4}$
- (4) none of these

24. A gardener brought 5 rabbits, after 2 months rabbits became 10, and after 4 months they became 20. If the growth continues in the same ratio, what would be the amount of rabbits after 1 year?

- (1) 300
- (2) 425
- (3) 635
- (4) none of these

25. The point of a parabola which is closest to the focus is the _____ of parabola.

- (1) vertex
- (2) latusrectum
- (3) directrix
- (4) none of these

26. If the discriminant of a conic is $h^2 - ab = 0$, then it represents a

- (1) circle
- (2) parabola
- (3) hyperbola
- (4) none of these

27. π denotes the ratio of the _____ to the _____.

- (1) area of a circle, circumference of the circle
- (2) area of a circle, length of its diameter
- (3) circumference of a circle, length of its diameter
- (4) none of these

28. $(-i)^{-19} = ?$

- (1) 1
- (2) -1
- (3) $-i$
- (4) none of these

29. Without repetition of the numbers, four digit numbers are formed with the numbers 0, 2, 3, 5. The probability of such a number divisible by 5 is

- (1) $\frac{1}{5}$
- (2) $\frac{4}{5}$
- (3) $\frac{5}{9}$
- (4) none of these

30. The probability that at least one of the events A and B occurs is 0.6. If A and B occur simultaneously with probability 0.2, then $P(\bar{A}) + P(\bar{B})$ is

- (1) 0.4
- (2) 0.8
- (3) 1.2
- (4) none of these

31. Which of the following is the converse of the statement : "If $x > 4$, then $x + 2 > 5$ " ?

- (1) if $x + 2 < 5$, then $x < 4$
- (2) if x is not greater than 4, then $x + 2$ is not greater than 5
- (3) if $x + 2 > 5$, then $x > 4$
- (4) none of these

32. Let p and q be two propositions given by p : I take medicine, q : I can sleep then, the compound statement $\sim p \sim q$ means

- (1) I take medicine iff I can sleep.
- (2) If I do not take medicine, then I cannot sleep.
- (3) If I do not take medicine, then I can sleep.
- (4) None of these

33. The contrapositive of statement 'If Chandigarh is capital of Punjab, then Chandigarh is in India' is

- (1) If Chandigarh is not in India, then Chandigarh is not the capital of Punjab.

(2) If Chandigarh is in India, then Chandigarh is Capital of Punjab.

(3) If Chandigarh is capital of Punjab, then Chandigarh is not in India.

(4) None of these

34. What is the value of k when $f(x) = kx^3 - 4x^2 - 3x + 5$ is divided by $x + 1$ and the remainder is 3?

- (1) 1
- (2) -1
- (3) 2
- (4) none of these

35. Find a matrix A, if $A + \begin{pmatrix} 2 & 3 & 3 & 6 \\ 1 & 4 & 3 & 8 \end{pmatrix}$

- (1) $\begin{pmatrix} 1 & 9 \\ 2 & 4 \end{pmatrix}$
- (2) $\begin{pmatrix} 1 & -9 \\ 2 & 4 \end{pmatrix}$
- (3) $\begin{pmatrix} 4 & 8 \\ 3 & 1 \end{pmatrix}$
- (4) none of these

36. Let $f(x) = |x - 1|$. Then

- (1) $f(x^2) = [f(x)]^2$
- (2) $f(x + y) = f(x) + f(y)$
- (3) $f(|x|) = |f(x)|$
- (4) none of these

37. Let $\vec{a} = 2\hat{i} + \hat{j} - \hat{k}$ and $\vec{b} = \hat{i} + \hat{j}$, If \vec{c} is a vector such that $\vec{a} \cdot \vec{c} = |\vec{c}|$, $|\vec{c} - \vec{a}| = \sqrt{5}$ and the angle between $\vec{a} \times \vec{b}$ and \vec{c} is 30° , then $|(\vec{a} - \vec{b}) \times \vec{c}|$ is equal to?

- (1) $\frac{2}{3}$
- (2) $\frac{\sqrt{3}}{2}$
- (3) 2
- (4) None of these

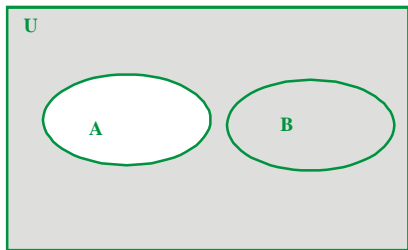
38. $\int_0^1 \sqrt{\frac{1 - \cos 2x}{2}} dx$ is equal to

- (1) $\sqrt{2}$
- (2) 0
- (3) 1
- (4) none of these

39. The locus of a variable point whose distance from $(-2, 0)$ is $\frac{2}{3}$ times its distance from the line $x = \frac{-9}{2}$ is

- (1) ellipse
- (2) parabola
- (3) hyperbola
- (4) none of these

40. The shaded region of the venn diagram



is represented by?

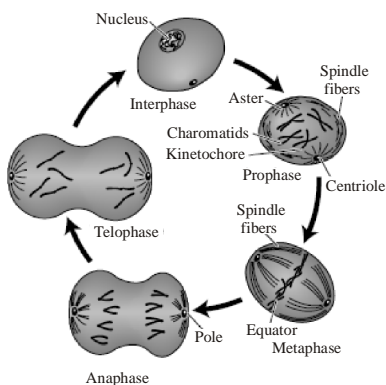
- (1) A'
- (2) B'
- (3) A – B
- (4) None of these

INTERACTIVE SECTION

41. Student in a biology class thought that salt water would affect the movements of planaria. They put 25 planaria in salt water and recorded their observations. Which flaw was present in the design of their experiment?

- (1) There was no control
- (2) There was no hypothesis
- (3) The sample was too big
- (4) None of these

42. Which of the following phases is the first step in mitosis?

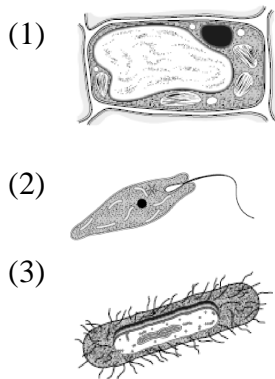


- (1) Prophase
- (2) Telophase
- (3) Metaphase
- (4) None of these

43. Change in species is described as a process that usually occurs over long periods of time. Yet, even though antibiotics have only been widely used for fifty years, scientists recognize that overuse of antibiotics has led to antibiotic-resistant strains of bacteria. The reason this can occur in a relatively short span of time is that-

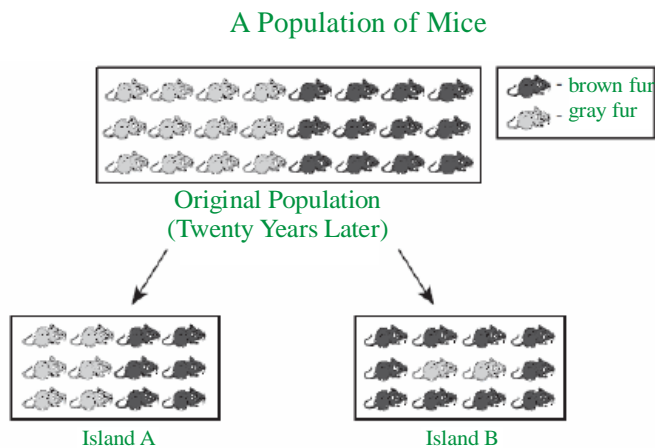
- (1) bacteria reproduce rapidly
- (2) travelers carry bacteria around the world
- (3) bacteria are very small
- (4) none of these

44. Which of these is the best model of a prokaryotic cell?



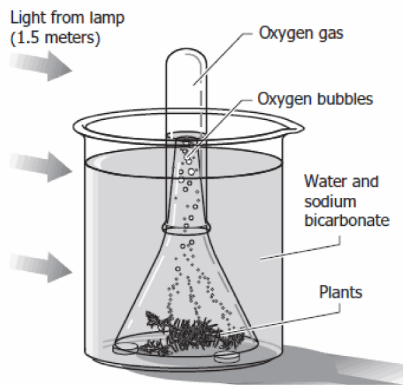
- (4) none of these

45. A population of mice is evenly divided into two groups, and each group is placed on an isolated island with no existing mouse population. Which statement *best* explains the difference in the mouse populations on Island A and Island B at the end of the 20 years?



- (1) More brown mice were in the half of the original population that was sent to Island B then in the group sent to Island A.
- (2) Conditions on Island B favored the brown-furred individuals, while both fur colors were evenly advantaged on Island A.
- (3) The recapturing of mice on Island A and Island B was done differently.
- (4) None of these

46. The picture shows a student's experiment with Elodea, a common aquatic plant. Which change in this experiment is most likely to increase the volume of oxygen gas that accumulates in the top of the tube?



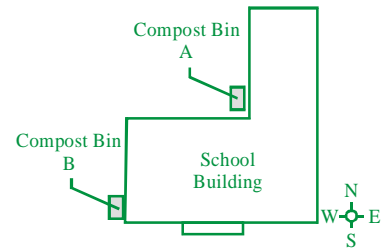
- (1) Replace the beaker with a larger container
- (2) Use fewer plants
- (3) Move the light source closer to the beaker
- (4) None of these

47. Which set of materials would be best to use to prepare a wet mount slide of onion skin cells?

- (1)
- (2)
- (3)

(4) none of these

48.



As part of an experiment to measure decomposition rates of different materials, students put food scraps from the cafeteria in compost bin A and leaves and grass clippings in compost bin B for six weeks. Students in first period measured the temperature in bin A, and students in sixth period measured the temperature in bin B. What is the *greatest* error in the students' experimental design?

- (1) Temperature is the only dependent variable in the experiment.
- (2) There are too many uncontrolled variables in the experiment.
- (3) The students put equal masses of materials in each bin.
- (4) None of these

49. A student observed that the colour of pH paper changes to green when she dipped it in water. She added a few drops of concentrated hydrochloric acid to the water. The colour of pH paper would turn to

- (1) light red
- (2) apple green
- (3) dark blue
- (4) none of these

50. A Student hypothesizes that thick leg muscles are an inherited trait in dogs. The student collects data on several dogs, and the data show that dogs that live outdoors have thicker leg muscles than dogs that live indoors. What should the student conclude?

- (1) Dogs with thick leg muscles may require more exercise than dogs with thin leg muscles.
- (2) Inheritance alone may not account for thick leg muscles in dogs.
- (3) Dogs that inherit thick leg muscles may not survive indoors.
- (4) None of these



END OF THE EXAM