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**NATIONAL  
BIOTECHNOLOGY  
OLYMPIAD**

**N B T O**

**12**  
Class

**A1**  
Paper  
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### IMPORTANT INFORMATION

- You are allowed additional 10 minutes to fill the required details in the **RESPONSE SHEET**.
- 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 coordinator teacher.
- 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.

### GENERAL KNOWLEDGE

- Tobacco smoke is injurious to health because it contains
  - carbon monoxide
  - nicotine
  - polycyclic aromatic hydrocarbons
  - all of these
- Commercial cork is obtained from the bark of
  - elm
  - maple
  - oak
  - None of these
- NARI stands for
  - National AIDS Research Institute
  - National Aeronautical Research Institute
  - National Awareness Research Institute
  - None of these
- Which of the following has/have been included by the National Board for Wildlife in the list of gravely endangered Indian Wildlife species?
  - Asiatic Lions
  - Gangetic Dolphins
  - Wild Buffaloes
  - All of them.
- The National Vector Borne Disease Control Programme does not cover which of the following disease?
  - Dengue
  - Polio
  - Malaria
  - None of these
- Direction: Study the information given below and answer the question that follows:  
A, B, C, D, E and F are cousins. No two cousins are of the same age, but all have birthdays on the same date. The youngest is 17 years old and the oldest E is 22. F is somewhere between B and D in age. A is older than B. C is older than D.  
Which of the following is not possible?
  - F is 18 years old
  - D is 20 years old
  - F is 19 years old
  - None of these
- 'Science Safari' is a –
  - Film that showcases Indian Science and Technology
  - Scientific project launched by ISRO
  - New remote sensing satellite
  - None of these
- In the hydrosphere, ocean water unsuitable for human use is
  - 92 percent
  - 94 percent
  - 96 percent
  - None of these
- Tamiflu is
  - a type of influenza originating in Tamilnadu
  - an effective medicine for birdflu
  - a form a bird flu
  - None of these

10. According to the recent research the amount of which of the following gases being absorbed by the world's oceans has reduced?
- (1) Carbon dioxide (2) Carbon monoxide  
(3) Sulphur dioxide (4) None of these

### SECTION B : PHYSICS & CHEMISTRY

11. The resistance of an ideal voltmeter is  
(1) zero (2)  $100 \Omega$   
(3) infinity (4) None of these
12. If an electron moves in a circular path of radius 15 cm in a magnetic field of  $4 \times 10^{-5}$  T, then speed of the electron is  
(1)  $0.2 \times 10^7$  m/s (2)  $3.01 \times 10^4$  m/s  
(3)  $1.06 \times 10^6$  m/s (4) None of these
13. In n-p-n transistor the majority carriers are  
(1) holes (2) base  
(3) electrons (4) None of these
14. A point charge of 'q' coulomb is placed at the centre of a cube of side 2 cm. The flux through one of the cube faces is equal to  
(1)  $\frac{q}{6\epsilon_0}$  (2)  $\frac{6\epsilon_0}{q}$   
(3)  $\frac{q}{-6\epsilon_0}$  (4) None of these
15. The magnification of normal telescope is 18. The focal length of eye-piece is 3 cm, the focal length of objective is  
(1) 18 cm (2) 54 cm  
(3) 36 cm (4) None of these
16. Which of the following molecules are expected to exhibit intermolecular hydrogen bonding?  
(a) Acetic acid (b) *o*-nitrophenol  
(c) *m*-nitrophenol (d) None of these
- Select the correct answer.  
(1) a, c and d (2) b and d  
(3) a, b and c (4) None of these
17. Hybridised state of central atom and shape of molecules in  $\text{IF}_5$  is  
(1)  $\text{sp}^3\text{d}$ , trigonal bipyramidal  
(2)  $\text{sp}^3\text{d}^2$ , square pyramidal  
(3)  $\text{sp}^3\text{d}$ , seesaw  
(4) None of these
18. IUPAC name of the compound is.  

$$\begin{array}{c} \text{CH}_3-\text{CH}-\text{CH}_2-\text{CHOH}-\text{CH}_3 \\ | \\ \text{CH}_2 \\ | \\ \text{CH}_3 \end{array}$$
  
(1) 4-methyl-3-hexanol (2) Heptanol  
(3) 4-methyl-2-hexanol (4) None of these
19. Which of the following is simple ether.  
(1)  $\text{C}_6\text{H}_5-\text{O}-\text{CH}_3$  (2)  $\text{CH}_3-\text{O}-\text{C}_2\text{H}_5$   
(3) MeOMe (4) None of these

20. Sea water contains  $5.8 \times 10^{-3}$  gm of dissolved oxygen per kg. Concentration of oxygen in parts per million (ppm) is  
(1) 58 ppm (2) 5.8 ppm  
(3) 0.58 ppm (4) None of these

### SECTION C : MATHEMATICS

21. If  $f$  and  $g$  are continuous functions in  $[0, 1]$  satisfying  $f(x) = f(a-x)$  and  $g(x) + g(a-x) = a$  then what is  $\int_0^a f(x)g(x)dx$  equal to?  
(1)  $\int_0^a f(x)dx$  (2)  $a \int_0^a f(x)dx$   
(3)  $\frac{a}{2} \int_0^a f(x)dx$  (4) None of the above
22. What is  $\lim_{x \rightarrow 2} \frac{\sin(e^{x-2} - 1)}{\ln(x-1)}$  equal to?  
(1) 0 (2) 1  
(3) -1 (4) None of these
23. What is the degree of the differential equation  $x = 1 + xy \left( \frac{dy}{dx} \right) + \frac{x^2 y^2}{2} \left( \frac{dy}{dx} \right)^2 + \frac{x^3 y^3}{6} \left( \frac{dy}{dx} \right)^3 + \dots$ ?  
(1) 1 (2) 2  
(3) 3 (4) cannot be determined
24. What is the ratio of the two integrals  $\int_0^{\pi} f(\sin x) dx : \int_0^{\frac{\pi}{2}} f(\sin x) dx$ ?  
(1) 1/2 (2) 2  
(3)  $\pi/2$  (4) None of these
25. What is the value of the error when  $\frac{2}{11}$  is approximated by 0.18?  
(1)  $\frac{1}{55}$  (2)  $\frac{1}{550}$   
(3)  $\frac{1}{110}$  (4) None of these
26. What is the amplitude of  $\sin \frac{\pi}{5} + i \left( 1 - \cos \frac{\pi}{5} \right)$ ?  
(1)  $\frac{\pi}{5}$  (2)  $\frac{\pi}{10}$   
(3)  $\frac{\pi}{15}$  (4) None of these
27. If the coefficient of  $x^7$  and  $x^8$  in  $\left( 2 + \frac{x}{3} \right)^n$  are equal, then  $n$  is equal to :

- (1) 56 (2) 45  
(3) 55 (4) None of these
28. What is the value of  $m$  for which the vectors  $m\hat{i} + \hat{j} - 2\hat{k}$ ,  $\hat{i} + \hat{j} + 3\hat{k}$ ,  $8\hat{i} + 5\hat{j}$  are coplanar?  
(1)  $-2$  (2)  $5$   
(3)  $2$  (4) None of these
29. If  $f(x)$ ,  $g(x)$ ,  $h(x)$  are three polynomials of degree 2, what is the degree of the polynomial  $\varphi(x)$  where
- $$\varphi(x) = \begin{vmatrix} f(x) & g(x) & h(x) \\ f'(x) & g'(x) & h'(x) \\ f''(x) & g''(x) & h''(x) \end{vmatrix}?$$
- (1) 3 (2) 2  
(3) 1 (4) None of these
30. If  $A$  and  $B$  are two events such that  $P(A \cup B) = \frac{1}{2}$  and  $P(\bar{A}) = \frac{2}{3}$ , then what is  $P(\bar{A} \cap B)$ ?  
(1)  $\frac{1}{3}$  (2)  $\frac{1}{6}$   
(3)  $\frac{1}{2}$  (4) None of these
31. If  $f(x) = |\sin x - \cos x|$ , then which one of the following is correct?  
(1)  $f'(\pi/4)$  does not exist.  
(2)  $f'(\pi/4)$  exists and is positive.  
(3)  $f'(\pi/4)$  exists and is negative.  
(4) None of these
32.  $AB$  and  $CD$  are the diameters of a circle of radius 1 unit with centre  $O$ .  $PB$  and  $PD$  are tangents at  $B$  and  $D$  which meet at the point  $P$ . If  $BC = 1$  unit, then what is the area of the triangle  $PBD$ ?  
(1)  $3\sqrt{3}$  square units (2)  $3\sqrt{3}/2$  square units  
(3)  $3\sqrt{3}/4$  square units (4) None of these
33. Greatest among  $\sqrt[4]{3}$ ,  $\sqrt[8]{10}$ ,  $\sqrt[12]{25}$  is .....  
(1)  $\sqrt[4]{3}$  (2)  $\sqrt[8]{10}$   
(3)  $\sqrt[12]{25}$  (4) All are equal
34.  $\frac{\sqrt{2}}{\sqrt{3+\sqrt{5}} - \sqrt{3-\sqrt{5}}} = \dots\dots\dots$   
(1) 1 (2)  $\sqrt{2}$   
(3)  $\sqrt{5}$  (4) None of these

35. Let  $R$  be a relation defined as  $R = \{(a, b) : a \leq b\}$  where  $a, b$  are real numbers. Then relation  $R$  is  
(1) Reflexive, symmetric and transitive  
(2) Reflexive and transitive but not symmetric  
(3) Symmetric and transitive but not reflexive  
(4) None of these
36. The distance between the origin and the centroid of the tetrahedron shows vertices are  $(0, 0, 0)$ ,  $(a, 0, 0)$ ,  $(0, b, 0)$ ,  $(0, 0, c)$  is  
(1)  $\sqrt{a^2 + b^2 + c^2}$  (2)  $\frac{\sqrt{a^2 + b^2 + c^2}}{2}$   
(3)  $\frac{\sqrt{a^2 + b^2 + c^2}}{4}$  (4) None of these
37.  $\lim_{x \rightarrow 0} \sqrt{x} \sin\left(\frac{\theta}{x}\right)$   
(1) 0 (2) 1  
(3)  $\alpha$  (4) None of these
38.  $\lim_{x \rightarrow \infty} \left(\frac{x-2}{x+1}\right)^{x+3}$   
(1)  $\frac{1}{e}$  (2)  $\frac{1}{e^2}$   
(3)  $\frac{1}{e^3}$  (4) None of these
39.  $\int \frac{\cos x}{1 - \cos^2 x} dx$   
(1)  $\tan x + c$  (2)  $-\operatorname{cosec} x + c$   
(3)  $\sec x + c$  (4) None of these
40.  $\int_{-2}^2 \frac{x}{|x|} dx =$   
(1) 4 (2) 2  
(3) 0 (4) None of these

### SECTION C : BIOLOGY

21. The diagram below shows what occurred when a can of diet soda and a can of regular soda were dropped into a container of water.



The can of regular soda sank to the bottom of the container, but the can of diet soda floated. Which of the following statements **best** explains this observation?

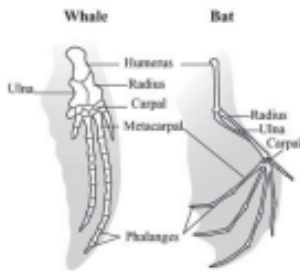
- (1) The can of regular soda is less dense than the can of diet soda.
- (2) The can of regular soda is more dense than the can of diet soda.
- (3) The can of regular soda has a larger volume than the can of diet soda.
- (4) None of these

22. The diagram below shows the chromosomes from a cell after they were photographed under a microscope.



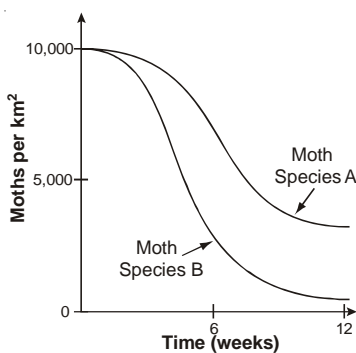
Which of the following questions may **best** be answered by studying an organism's chromosomes?

- (1) What sex is the organism?
  - (2) Is the organism endangered?
  - (3) Where is the organism's ecosystem?
  - (4) None of these
23. The bones of a whale flipper are similar to the bones of a bat wing as shown in the illustration below.



What does this similarity in bone structure suggest about the whale and the bat?

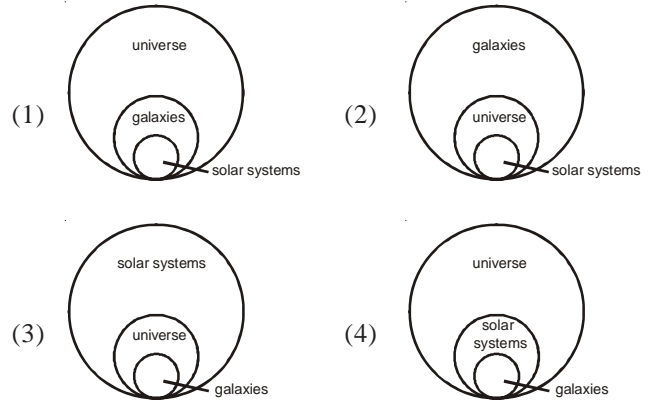
- (1) They use the same methods to travel.
  - (2) They evolved from a common ancestor.
  - (3) They can migrate to the same locations.
  - (4) None of these
24. The praying mantis is a predatory insect that often eats moths. The graph below shows the relative numbers of two species of moths over 12 weeks after the introduction of the predatory praying mantis.



What characteristic of this ecosystem is **best** indicated from

this graph?

- (1) Species B was preferred as food over species A.
  - (2) Species B may replace species A in this environment.
  - (3) Species B will reproduce more rapidly than species A.
  - (4) None of these
25. Which of the following diagrams **best** represents the relationship between galaxies, the universe, and solar systems?



26. A researcher found shark fossils on top of a mountain. This evidence suggests which of the following about this region?
- (1) It was once below a waterfall.
  - (2) It was once part of a riverbed.
  - (3) It was once covered by an ocean.
  - (4) None of these
27. The picture below shows an iron.



When considering an iron as an example of a system, what is the input?

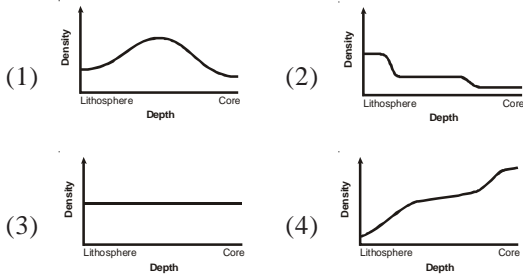
- (1) electricity
  - (2) temperature
  - (3) motion on clothes
  - (4) None of these
28. The illustration below shows three types of unicellular organisms commonly found in pond water.



Based on the illustration, which of the following can be used to separate these organisms into three different groups?

- (1) length of lifespan (2) method of movement  
(3) presence of a nucleus (4) None of these

29. Which of the following graphs **best** represents the relationship between density and depth of material below Earth's surface?



30. The Moon orbits Earth at a speed of approximately one kilometer per second. The Moon is kept in orbit by which of the following?

- (1) gravity (2) lunar phases  
(3) magnetism (4) None of these

31. The illustration below shows an architect's model of an office building.



Which of the following is **most likely** the purpose of this model?

- (1) to guide the drafting of the building's plans  
(2) to test the strength of the construction technique  
(3) to inventory the materials needed for construction  
(4) to show some of the characteristics of the finished structure

32. The inherited disease, phenylketonuria is due to

- (1) distortion of tissue system in brain  
(2) homozygous recessive individual lacks the enzyme  
(3) decrease in amount of phenylalanine in blood  
(4) none of these

33. "One gene one enzyme hypothesis" was stated by

- (1) Watson and Crick (2) Beadle and Tatum  
(3) Leibig and Pasteur (4) August Weismann

34. In  $C_4$ -plants, the carbon dioxide fixation occurs in

- (1) guard cells (2) bundle sheath cells  
(3) spongy cells (4) None of these

35. The number of hydrogen bonds between Guanine and cytosine in a DNA molecule is

- (1) two (2) six  
(3) three (4) None of these

36. A chemical compound having which of the following hormone is used for artificial ripening of fruits?

- (1) IAA (2) ethylene  
(3) zeatin (4) None of these

37. Single stranded DNA is found in

- (1) TMV (2) Wound Tumour Virus  
(3) Reovirus (4) None of these

38. Fruit of *Hibiscus rosa sinensis* is

- (1) dry indehiscent (2) dry dehiscent  
(3) fleshy (4) None of these

39. Fructose 1, 6-biphosphate splits into two triose phosphates by which of the following enzyme?

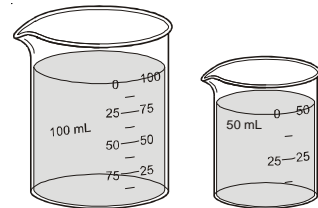
- (1) enolase (2) sucrase  
(3) aldolase (4) None of these

40. Which pigment is essential for nitrogen fixation by leguminous plants?

- (1) anthocyanin (2) leghaemoglobin  
(3) phycocyanin (4) None of these

### ETG INTERACTIVE SECTION

41. The two beakers below contain pure water.



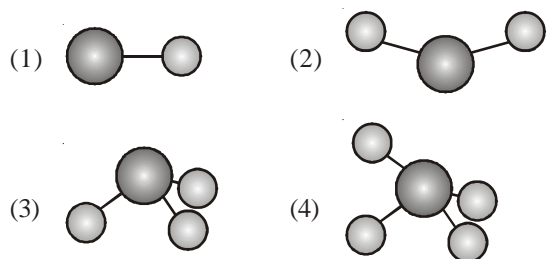
Which of the following properties is the same for both of these samples?

- (1) mass (2) boiling point  
(3) volume (4) None of these

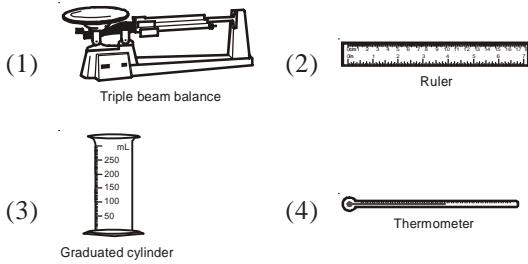
42. Index fossils help scientists estimate the age of a rock because index fossil species only existed for a relatively short time. What happened to the species that are now used as index fossils?

- (1) They became extinct.  
(2) They changed their diets.  
(3) They hid in marine sediments.  
(4) None of these

43. Below are four ball-and-stick models representing compounds. Which of these models **best** represents ammonia ( $NH_3$ )?



44. Which of the following instruments is **best** used to measure the volume of a small irregularly shaped solid?

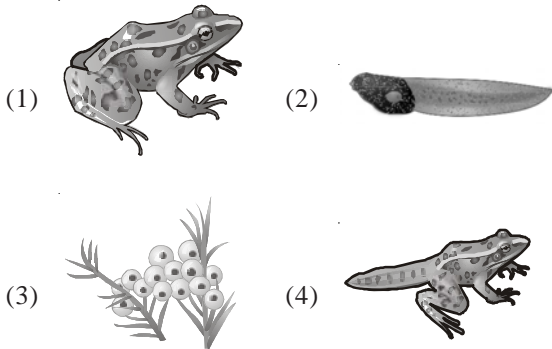


45. The following diagram shows a caterpillar, mold, and a fern.

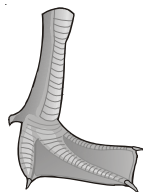


What do these organisms have in common?

- (1) They are made of cells.
  - (2) They produce their own food.
  - (3) They decompose other organisms.
  - (4) None of these
46. Spirogyra are green algae that can reproduce sexually. Which of the following features identifies reproduction in Spirogyra as sexual reproduction?
- (1) The cells of parent algae have nuclei.
  - (2) Genetic material is contributed by two parent cells.
  - (3) Several offspring may be produced at once.
  - (4) None of these
47. Which of the following pictures shows a stage in a frog's life cycle when it breathes entirely through gills?



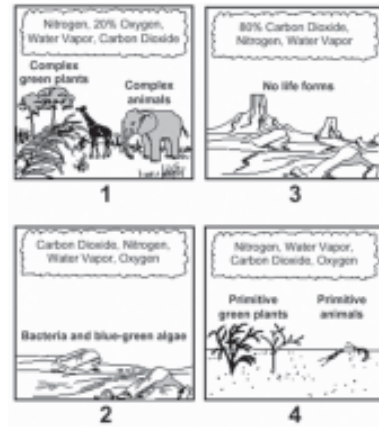
48. The picture below shows the foot of a certain species of bird.



In which of the following environments is this species best adapted for survival?

- (1) desert
- (2) freshwater lake
- (3) meadow
- (4) tropical rain forest

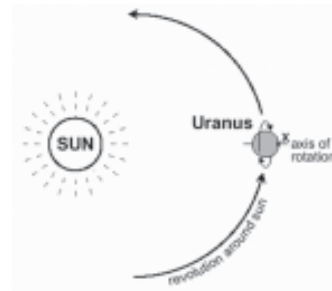
49.



The diagrams show that as life forms changed on Earth so did the composition of the atmosphere. The correct order of these changes over geologic time is –

- (1) 2, 3, 1, 4
- (2) 2, 3, 4, 1
- (3) 3, 4, 2, 1
- (4) 3, 2, 4, 1

50.



The planet Uranus is unusual because its axis of rotation lies almost in the plane of its revolution. If the axis is pointing toward the sun as in the picture, what would occur at point X when the planet turns once on its axis?

- (1) The point would be in darkness for the complete rotation of the planet.
- (2) The point would be in daylight for the full rotation.
- (3) The point would be in twilight for the full rotation.
- (4) The point would be in daylight for half the time and in darkness for half the time.



**END OF THE EXAM**