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*# See prospectus/website for details

EHF NATIONAL IIT-PMT OLYMPIAD

N I P O

12 Class

A1 Paper Code

L E V E L - 1

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.

PHYSICS

1. Which of the following pairs does not have same dimensions?
(1) Angular momentum and Planck's constant
(2) Moment of inertia and moment of force
(3) Work & torque
(4) None of these

2. A passenger sitting in a moving railway carriage throws a ball vertically upwards. The ball would fall in front of him if the train is moving with a/an
(1) Acceleration (2) Retardation
(3) Both (1) and (2) (4) None of these

3. A body of mass 5 kg is moving in a circle of radius 1 m with an angular velocity of 2 radians/s. The centripetal force is
(1) 10 N (2) 20 N
(3) 30 N (4) None of these

4. A spring extended by 20 mm possesses a potential energy of 10 J. If the extension of the spring becomes 30 mm, its potential energy will be
(1) 15 J (2) 22.5 J
(3) 6.6 J (4) None of these

5. Particle A makes a perfectly elastic collision with another particle B at rest. They fly apart in opposite directions with equal speeds. The ratio of their masses mA/mB is
(1) 1/2 (2) 1/3
(3) 1/4 (4) None of these

6. If the diameter of the earth becomes two times of its present value and its mass remains unchanged, then how would be the weight of an object on the surface of the earth be effected?
(1) It will become half
(2) It will become one-fourth
(3) It will become double
(4) None of these

7. The gravitational attraction between the two bodies increases when their masses are
(1) Reduced and distance is reduced
(2) Increased and distance is reduced
(3) Reduced and distance is increased
(4) None of these

8. We go up in the atmosphere in a balloon upto height of about 40 km and note the temperature. Which of the following statements is correct?
(1) The temperature will go on falling and at a certain height, it will become practically constant. With further increase in height the temperature rises again.
(2) The temperature will go on rising with altitude continuously
(3) The temperature will go on falling and at a certain height it will reach practically a constant temperature and it will not change with further increase in height
(4) None of these

9. A simple pendulum attached to the roof of a lift has a time period of 2 s in a stationary lift. If the lift is allowed to fall freely the frequency and time period of oscillation of pendulum will be
(1) Zero, infinity (2) 2Hz, zero
(3) 0.5 Hz, infinity (4) None of these

10. Force acting upon a charged particle kept between the plates of a charged condenser is F. If one of the plates of the condenser is removed, then the force acting on the same particle will become
(1) Zero (2) F/2
(3) F (4) None of these

11. Two unequal resistances are connected in parallel across a cell. Which of the following statement is true?
(1) Current through a smaller resistance is more
(2) Current through a larger resistance is more
(3) Current is same through both the resistances
(4) None of these

12. A planet is observed by an astronomical refracting telescope having an objective of focal length 16 m and an eyepiece of focal length 2 cm
(1) The distance between the objective and the eyepiece is 16.02m
(2) The angular magnification of the planet is 800
(3) Both (1) and (2)
(4) None of these

13. A double convex lens is made of glass which has its refractive index of 1.55 for violet rays and 1.50 for red rays. If the focal length for violet rays is 20 cm, then focal length for red ray will be
(1) 18.5 cm (2) 18 cm
(3) 20 cm (4) None of these

14. A ball is thrown with a velocity whose horizontal component is 12 ms^{-1} from a point 1.3 m above the ground and 6 m away from a vertical wall 4.9 m high in such a way so as just to clear the wall. At what time will it reach the ground? (take g = 10 ms^{-2}).
(1) 2.1 sec (2) 2.6 sec
(3) 3 sec (4) None of these

15. The gravitational potential difference between the surface of a planet and a point 10 m above it is 8 J/kg. The work done in moving a body of mass 4.0 kg by 6m on a slope of 30° from the horizontal is given by
(1) 6.4 J (2) 9.6 J
(3) 32 J (4) None of these

CHEMISTRY

16. An aqueous solution of 6.3 g oxalic acid dihydrate is made up to 250 ml. The volume of 0.1 N NaOH required to completely neutralize 10 ml of this solution is
(1) 40 ml (2) 20 ml
(3) 12 ml (4) None of these

17. The correct order of equivalent conductance at infinite dilution of LiCl, NaCl and KCl is
(1) LiCl > NaCl > KCl (2) KCl > NaCl > LiCl
(3) NaCl > KCl > LiCl (4) None of these

18. Transition metals are often paramagnetic owing to
(1) Their high melting point and boiling point
(2) The presence of vacant orbitals
(3) The presence of one or more unpaired electrons in the system
(4) None of these

19. Helium atom is two times heavier than a hydrogen molecule. At 298°K, the average kinetic energy of a helium atom is
(1) Two times that of a hydrogen molecule
(2) Same as that of a hydrogen molecule
(3) Four times that of a hydrogen molecule
(4) None of these

20. The circumference of the 4th Bohr's orbit in hydrogen atom is 5.32 nm. The de Broglie wave length of electron is
(1) 0.133 nm (2) 13.3 nm
(3) 1.33 nm (4) None of these

21. Consider an ideal gas contained in a vessel. If the intermolecular interactions suddenly begins to act, which of the following will happen?
(1) The pressure decreases
(2) The pressure increases
(3) The pressure remains unchanged
(4) None of these

22. If 0.50 mole of $BaCl_2$ and 0.20 mole of sodium phosphate (Na_3PO_4) are reacted, then moles of barium phosphate [$Ba_3(PO_4)_2$] will be
(1) 0.4 mole (2) 0.10 mole
(3) 0.2 mole (4) None of these

23. If thio-cyanide ion is added to potash-ferric alum then red colour appears. This colour is due to the formation of
(1) KSCH (2) $Fe(SCN)_3$
(3) $Fe(SCN)_2$ (4) None of these

24. Sodium thiosulphate is used in photography to
(1) Reduce AgBr grains to metallic Ag
(2) Dissolve out Ag produced by reduction
(3) Remove unaffected AgBr in the photo-graphic film or plate
(4) None of these

25. LiCl is soluble in organic solvents while NaCl is not because
(1) Lattice energy of NaCl is less than that of LiCl
(2) LiCl is more covalent compound than NaCl
(3) Li+ has more hydration energy than Na+ ion
(4) None of these

26. Propane is obtained from propene by which method?
(1) Catalyst hydrogenation
(2) Wurtz reaction
(3) Dehydrogenation
(4) None of these

27. Rutherford's experiment which established the nuclear model of the atom, used a beam of
(1) Beta-particles, which impinged on a metal foil and got absorbed
(2) Gama-rays, which impinged on a metal foil and ejected electrons
(3) Helium nuclei, which impinged on a metal foil and got scattered
(4) None of these

28. Which of the following compounds exhibits stereoisomerism?
(1) 2-methylbutene-1
(2) 3-methylbutyne-1
(3) 2-methylbutanoic acid
(4) None of these

29. Identify the least stable ion amongst the following
(1) Li^- (2) Be^-
(3) B^- (4) None of these

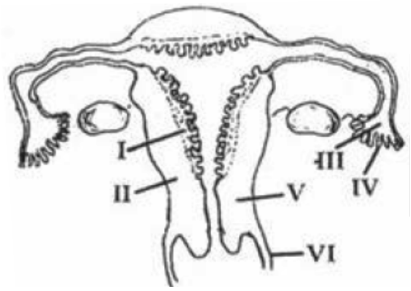
30. H_3BO_3 is
(1) Monobasic and Lewis acid
(2) Monobasic and weak Bronsted acid
(3) Monobasic and strong Lewis acid
(4) None of these

BIOLOGY

31. There is no natural death in single celled organisms like Amoeba and bacteria because:
(1) They cannot reproduce sexually
(2) They reproduce by binary fission
(3) Parental body is distributed among the offspring
(4) None of these

32. Appearance of vegetative propagules from the nodes of plants such as sugarcane and ginger is mainly because:
(1) Nodes are shorter than internodes
(2) Nodes have meristematic cells
(3) Nodes are located near the soil
(4) None of these

33. The figure given below depicts a diagrammatic sectional view of the female reproductive system of humans. Which one set of three parts out of I – VI have been correctly identified?



(1) (I) Perimetrium, (II) Myometrium, (III) Fallopian tube
(2) (II) Endometrium, (III) Infundibulum, (IV) Fimbriae
(3) (III) Infundibulum, (IV) Fimbriae, (V) Cervix
(4) None of these

34. Imagine that in pea plants genes for controlling seed coat colour and shape are present on the same chromosome very close together. Performing dihybrid experiments with these characters Mendel could not have been able to arrive at the idea of
(1) Independent assortment
(2) Dominance
(3) Segregation
(4) None of these

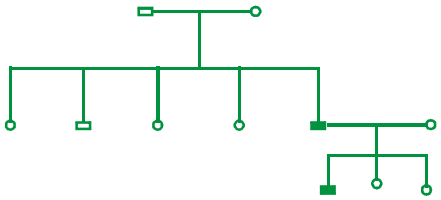
35. If one cell has twice as much DNA as another similar cell then it is most probable that it is

(1) Reproducing (2) Secreting
(3) Respiring (4) None of these

36. If complex carbohydrates are to be absorbed by a cell they must first be converted to

(1) Glycerol and fatty acid
(2) CO_2 and H_2O
(3) Simple sugars
(4) None of these

37. In human pedigree chart, the mutant trait is shaded black. The squares indicate males and circles females



From the above one can say that the gene responsible for the trait is

(1) Dominant and sex-linked
(2) Dominant but not sex-linked
(3) Recessive and sex-linked
(4) None of these

38. Method of controlling pest that relies on natural predation rather than introduced chemical

(1) Predation (2) Chemical control
(3) Biological control (4) None of these

39. HIV belongs to which of the following families of virus?

(1) Reovirus (2) Lentivirus
(3) Togavirus (4) None of these

40. Cancer cells can easily be destroyed by radiations due to

(1) Fast mutation (2) Rapid cell division
(3) Lack of mutation (4) None of these

41. A scientist wants to study the viral effects on plants. Which of the following part of the plant should be excluded?

(1) Pith (2) Shoot apex
(3) Phloem (4) None of these

42. In order to obtain virus free plants through tissue culture the best method is

(1) Meristem culture
(2) Protoplast culture
(3) Anther culture
(4) None of these

43. The first clinical gene therapy was done for the treatment of:

(1) AIDS (2) Cancer
(3) SCID (Severe Combined Immuno Deficiency resulting from deficiency of ADA)
(4) None of these

44. Some neurons in the vagus nerve terminate on sinoatrial (pacemaker) cells in the heart. These neurons secrete acetylcholine, which ultimately results in a decreased heart rate. This is an example of

(1) Endocrine control (2) Exocrine control
(3) Neural control (4) None of these

45. Manish is a sprinter who specialises in quick and powerful bursts of speed followed by periods of rest. Dev is a marathon runner who specializes in long, steady runs. Compared to Dev, Manish is likely to have

(1) Legs with a larger diameter
(2) Legs with a smaller diameter
(3) Hypertrophy of type 1 muscle fibres.
(4) None of these

46. Carbohydrates are commonly found as starch in plant storage organs. Which of the following five properties of starch (*i-v*) make it useful as a storage material?

(i) Easily translocated
(ii) Chemically non-reactive
(ii) Easily digested by animals
(iv) Osmotically inactive
(v) Synthesized during photosynthesis

The useful properties are:

(1) (i) and (v) (2) (ii) and (iii)
(3) (ii) and (iv) (4) None of these

47. Match the scientists listed under column '1' with ideas listed column '2'.

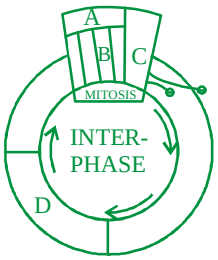
Column 1	Column 2
i. Darwin	M. Abiogenesis
ii. Oparin	N. Use and disuse of organs
iii. Lamarck	O. Continental drift theory
iv. Wagner	P. Evolution by natural selection

(1) i-M; ii-P; iii-N; iv-O (2) i-P; ii-M; iii-N; iv-O
(3) i-N; ii-P; iii-O; iv-M (4) None of these

48. The primary biological importance of sexual reproduction in an organism is that it

(1) Is necessary for the survival of the individual
(2) Causes new mutations to occur in the offspring
(3) Promotes genetic variability among offspring.
(4) None of these

49. In adjoining figure there is a schematic break-up of the phases/stages of cell cycle. Which one of the following is the correct indication of the stage/ phase in the cell cycle?



(1) A-Cytokinesis
(2) B-Metaphase
(3) D-Synthetic phase
(4) None of these

50. Match the branches of Biology given under column I with the field of study listed under column II; choose the answer which gives the correct combination of two columns.

Column I (Branch of Biology)	Column II (Field of study)
A. Malacology	p. Reptiles
B. Pomology	q. Fungi
C. Mycology	r. Fruits
D. Ornithology	s. Molluscs
	t. Birds

(1) $A = s; B = r; C = q; D = t$
(2) $A = p; B = r; C = r; D = t$
(3) $A = p; B = r; C = q; D = s$
(4) None of these

MATHEMATICS

31. The area bounded by the circle $x^2 + y^2 = a^2$ and the line $x + y = a$ in the first quadrant is

(1) $(\pi - 2)a^2$ (2) $\frac{1}{4}(\pi - 2)a^2$
(3) πa^2 (4) None of these

32. The area between the parabola $y^2 = 4ax$ and the line $y = mx$ is

(1) $\frac{8a^2}{3m^2}$ (2) $\frac{8a^2}{3m^3}$
(3) $\frac{8a^3}{3m^2}$ (4) None of these

33. The curve whose sub tangent is twice the abscissa of the point of contact passing through (1, 2) is

(1) $y^2 = 4x$ (2) $y^2 = -4x$
(3) $x^2 = 4y$ (4) None of these

34. The degree of differential equation of all tangent lines to the parabola $y^2 = 4ax$ is

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

35. If $\begin{vmatrix} 6i & -3i & 1 \\ 4 & 3i & -1 \\ 20 & 3 & i \end{vmatrix} = x + iy$, then

(1) $x = 3, y = 1$ (2) $x = 1, y = 3$
(3) $x = 0, y = 0$ (4) None of these

36. $2 + 3.2 + 4.2^2 + \ldots$ n terms = ...

(1) 2^n (2) $n.2^n$
(3) $n.2^{n-1}$ (4) None of these

37. Product of 3 consecutive natural numbers is divisible by .....

(1) 2 (2) 3
(3) 6 (4) None of these

38. If $\tan\theta + \cot\theta = a$ then $\tan^2\theta + \cot^2\theta$ = ...

(1) a^2 (2) $2a$
(3) $a^2 - 2$ (4) None of these

39. An aeroplane is flying horizontally 1 km above the ground and the angle of elevation is observed as 60° after 10 seconds the elevation of the aeroplane is observed as 30°, then the speed of aeroplane

(1) 200 kmph (2) $210\sqrt{3}$ kmph
(3) $240\sqrt{3}$ kmph (4) None of these

40. $\bar{a}, \bar{b}, \bar{c}$ are unit vectors and $\bar{a} + \bar{b} + \bar{c} = 0$ then $\bar{a}\cdot\bar{b} + \bar{b}\cdot\bar{c} + \bar{c}\cdot\bar{a}$ =

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

41. If the vectors $ai - 2j + 5k$, $i - bj + 5k$ are collinear then (a, b) =

(1) (2, –1) (2) (1, –2)
(3) (1, 2) (4) None of these

42. There are 3 candidates for a post and one is to be selected by the votes of 7 men. The number of ways in which votes can be given is:

(1) 7^3 (2) 3^7
(3) ${}^7C_3$ (4) None of these

43. A boy has 3 library tickets and 8 books of his interest in the library. Of these 8, he does not want to borrow Chemistry part 11 unless Chemistry Part 1 is also borrowed. In how many ways can he choose the three books to be borrowed?

(1) 56 (2) 27
(3) 41 (4) None of these

44. If $\cos(\alpha + \beta) = \frac{4}{5}$, $\sin(\alpha - \beta) = \frac{5}{13}$ and α, β lie between 0 and $\frac{\pi}{4}$, then find the value of $\tan 2\alpha$.

(1) 1 (2) $\frac{1}{\sqrt{3}}$

(3) $\frac{56}{33}$ (4) None of these

45. The domain of $f(x) = \frac{1}{\sqrt[3]{x-2}} + \sqrt{2x} + \log_e(3x-4)$ is

(1) $(0, \infty)$ (2) $\left(\frac{4}{3}, \infty\right)$

(3) $\left(\frac{4}{3}, 2\right) \cup (2, \infty)$ (4) None of these

46. The vector whose length is 12 and which is perpendicular to each of the vectors $6\hat{i} + 5\hat{j} - 2\hat{k}$ and $3\hat{i} + \hat{j} - 4\hat{k}$ is

(1) $-8\hat{i} + 8\hat{j} - 4\hat{k}$ (2) $8\hat{i} - 4\hat{j} - 8\hat{k}$

(3) $\hat{i} + \hat{j} - \hat{k}$ (4) None of these

47. $\int_0^{\infty} \frac{x \log x \, dx}{(1+x^2)^2}$ is equal to

(1) 1 (2) 0

(3) 2 (4) None of these

48. The inverse of the matrix $\begin{bmatrix} 7 & -3 & -3 \\ -1 & 1 & 0 \\ -1 & 0 & 1 \end{bmatrix}$ is

(1) $\begin{bmatrix} 1 & 1 & 1 \\ 3 & 4 & 3 \\ 3 & 3 & 4 \end{bmatrix}$ (2) $\begin{bmatrix} 1 & 3 & 1 \\ 4 & 3 & 8 \\ 3 & 4 & 1 \end{bmatrix}$

(3) $\begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$ (4) None of these

49. If $A = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$ and $B = \begin{vmatrix} c_1 & c_2 & c_3 \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix}$ then

(1) $A = -B$
(2) $A = B$
(3) $B = 0$
(4) None of these

50. A variable line $\frac{x}{a} + \frac{y}{b} = 1$ is such that $a + b = 4$. The locus of the midpoint of the portion of the line intercepted between the axes is

(1) $x + y = 4$
(2) $x + y = 8$
(3) $x + y = 2$
(4) None of these

END OF THE EXAM