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CLASS 12

LEVEL - 1

Set A1

EHF OLYMPIADS

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NATIONAL IIT-PMT OLYMPIAD (NIPO)

EHF NATIONAL IIT-PMT OLYMPIAD

Name :

Roll No :

Class :

School :



NATIONAL BIOTECHNOLOGY OLYMPIAD



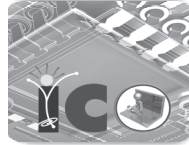
NATIONAL MATHS OLYMPIAD



NATIONAL SCIENCE OLYMPIAD



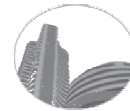
INTERNATIONAL CYBER OLYMPIAD



INTERNATIONAL ENGLISH OLYMPIAD



INTERNATIONAL GENERAL KNOWLEDGE OLYMPIAD



BSE
INVESTORS' PROTECTION FUND

BSE international finance olympiad (BIFO)



NATIONAL IIT-PMT OLYMPIAD (NIPO)

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.

Level - 2 : School toppers* will be selected for level-2-National level - online computer based interactive test held at exam centres all over India. Besides selection for level-3, winner will get merit certificate, medals, educational CDs, laptop, scholarship and other prizes. There is no level-2 in Art and Cricket.

Level - 3 : Toppers will qualify* for level-3-International level-where you will compete with students globally. Get selected for EHF's International Olympiad training camp. Only Indian organization giving students exposure to global competitions. Represent India & win laurels. Guidance by top scientists. Prizes ranges from cash (millions of \$), gadgets, foreign trips, publicity, fame, scholarships, Internships, conference participation and more.

* # See prospectus website for details

Instructions for the Candidate

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.

WEBSITE : WWW.EDUHEALFOUNDATION.ORG
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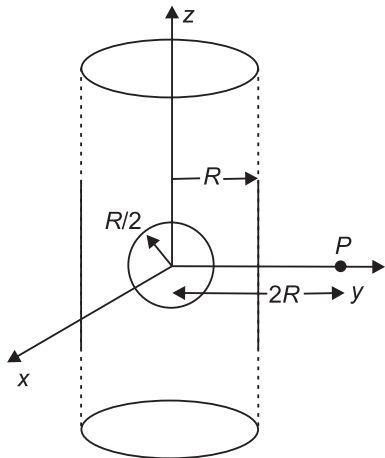
ROUGH WORK

PHYSICS

1. Three very large plates of same area are kept parallel and close to each other. They are considered as ideal black surfaces and have very high thermal conductivity. The first and third plates are maintained at temperatures $2T$ and $3T$ respectively. The temperature of the middle (i.e. second) plate under steady state condition is

- (1) $\left(\frac{65}{2}\right)^{\frac{1}{4}} T$ (2) $\left(\frac{97}{4}\right)^{\frac{1}{4}} T$
 (3) $\left(\frac{97}{2}\right)^{\frac{1}{4}} T$ (4) $(97)^{\frac{1}{4}} T$

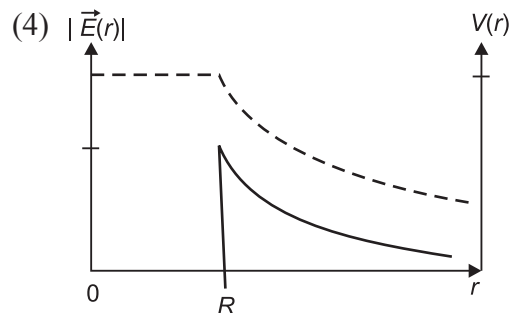
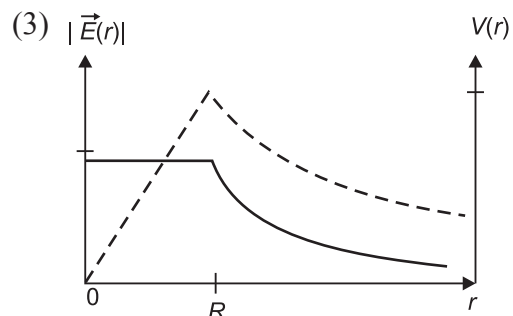
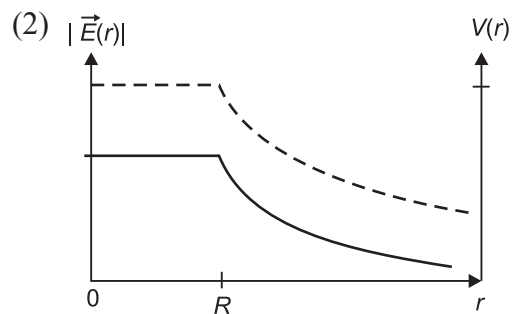
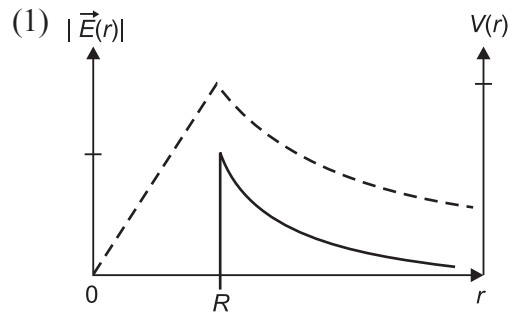
2. An infinitely long solid cylinder of radius R has a uniform volume charge density ρ . It has a spherical cavity of radius $R/2$ with its centre on the axis of the cylinder, as shown in the figure. The magnitude of the electric field at the point P , which is at a distance $2R$ from the axis of the cylinder, is given by the expression $\frac{23\rho R}{16k\epsilon_0}$. The value of k is



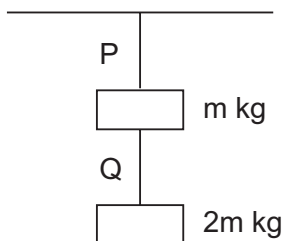
- (1) 2 (2) 4
 (3) 6 (4) 8
3. A proton is fired from very far away towards a nucleus with charge $Q = 120 e$, where e is the electronic charge. It makes a closest approach of 10 fm to the nucleus. The de Broglie wavelength (in units of fm) of the proton at its start is: (take the proton mass, $m_p = (5/3) \times 10^{-27}$ kg, $h/e = 4.2 \times 10^{-15}$ J.s/C; $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9$ m/F; 1 fm = 10^{-15} m)

- (1) 7
 (2) 8
 (3) 9
 (4) 10

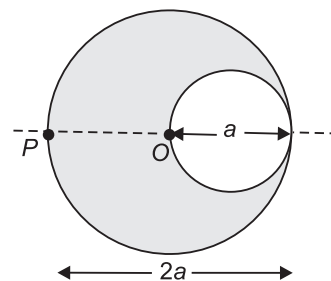
4. Consider a thin spherical shell of radius R with its centre at the origin, carrying uniform positive surface charge density. The variation of the magnitude of the electric field $|\vec{E}(r)|$ and the electric potential $V(r)$ with the distance r from the centre, is best represented by which graph?



11. Two wires P and Q of same diameter are loaded as shown in the figure. The length of wire P is L m and its young's modulus is Y N/m^2 while length of wire Q is twice that of P and its material has young's modulus half that of P. Compute the ratio of their elongation.





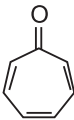
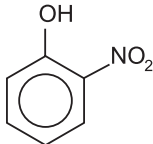
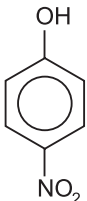
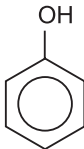
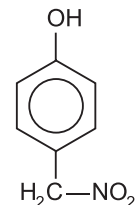
- (1) $\frac{4}{7}$ (2) $\frac{5}{9}$
 (3) $\frac{3}{8}$ (4) $\frac{5}{8}$
12. A shell of mass 0.020 kg is fired by a gun of mass 100 kg. If the muzzle speed of the shell is 80 m/s, what is the recoil speed of the gun?
- (1) 0.016 m/s (2) 0.026 m/s
 (3) 0.036 m/s (4) 0.046 m/s
13. A cylindrical cavity of diameter a exists inside a cylinder of diameter $2a$ as shown in the figure. Both the cylinder and the cavity are infinitely long. A uniform current density J flows along the length. If the magnitude of the magnetic field at the point P is given by $\frac{N}{12} \mu_0 aJ$, then the value of N is:



- (1) 5 (2) 10
 (3) 8 (4) 7
14. For the resistance network shown in the figure, choose the correct option.
-
- (1) $I_1 = 4\text{A}$ and $I_2 = 3\text{A}$ (2) $I_1 = 3\text{A}$ and $I_2 = 2\text{A}$
 (3) $I_1 = 3\text{A}$ and $I_2 = 5\text{A}$ (4) $I_1 = I_2 = 5\text{A}$
15. If the change in the value of g at the height h above the surface of the earth is the same as at a depth x below it, then (both x and h being much smaller than the radius of the earth)
- (1) $x = h$ (2) $x = 2h$
 (3) $x = \frac{h}{2}$ (4) $x = 3h$

CHEMISTRY

16. In allene (C_3H_4), the type(s) of hybridisation of the carbon atoms is (are)
- (1) sp and sp^3 (2) sp and sp^2
 (3) only sp^2 (4) sp^2 and sp^3
17. As per IUPAC nomenclature, the name of the complex $[\text{Co}(\text{H}_2\text{O})_4(\text{NH}_3)_2]\text{Cl}_3$ is
- (1) Tetraaquadiamminecobalt (III) chloride
 (2) Tetraaquadiamminecobalt (IV) chloride
 (3) Diaminetetraaquacobalt (IV) chloride
 (4) Diamminetetraaquacobalt (III) chloride
18. The carboxyl functional group ($-\text{COOH}$) is present in
- (1) picric acid
 (2) barbituric acid
 (3) ascorbic acid
 (4) aspirin

19. Which of the following molecules, in pure form, is (are) **unstable** at room temperature?
- (1)  (2) 
- (3)  (4) Both (1) and (3)
20. 29.2% (w/w) HCl stock solution has a density of 1.25 g mL^{-1} . The molecular weight of HCl is 36.5 g mol^{-1} . The volume (mL) of stock solution required to prepare a 200 mL solution of 0.4 M HCl is
- (1) 6 (2) 7
(3) 8 (4) 9
21. Ionisation energy of He^+ is $19.6 \times 10^{-18} \text{ J atom}^{-1}$. The energy of the first stationary state ($n = 1$) of Li^{2+} is
- (1) $4.41 \times 10^{-16} \text{ J atom}^{-1}$
(2) $-4.41 \times 10^{-17} \text{ J atom}^{-1}$
(3) $-2.2 \times 10^{-15} \text{ J atom}^{-1}$
(4) $2.2 \times 10^{-18} \text{ J atom}^{-1}$
22. If one mole of ammonia and one mole of hydrogen chloride are mixed in a closed container to form ammonium chloride gas, then
- (1) $\Delta H > \Delta u$
(2) $\Delta H = \Delta u$
(3) $\Delta H < \Delta u$
(4) both (1) and (2)
23. All the real gas change to solid before reaching
- (1) -273.16°C (2) 0°C
(3) 100°C (4) -373.26°C
24. In a compound, atoms of element Y form ccp lattice and those of element X occupy $2/3$ rd of tetrahedral voids. The formula of the compound will be
- (1) X_3Y_4 (2) X_4Y_3
(3) X_2Y_3 (4) X_5Y_2
25. The colour of light absorbed by an aqueous solution of CuSO_4 is
- (1) orange-red (2) blue-green
(3) yellow (4) violet
26. The kinetic energy of an electron in the second Bohr orbit of a hydrogen atom is [a_0 is Bohr radius]
- (1) $\frac{h^2}{4\pi^2 m a_0^2}$ (2) $\frac{h^2}{16\pi^2 m a_0^2}$
(3) $\frac{h^2}{32\pi^2 m a_0^2}$ (4) $\frac{h^2}{64\pi^2 m a_0^2}$
27. Most acidic phenol is-
- (1)  (2) 
(3)  (4) 
28. Which of the following dissolve(s) in excess of NaOH solution?
- (1) AgNO_3 (2) Zn(OH)_2
(3) BaSO_4 (4) $\text{Hg}_2(\text{NO}_3)_2$
29. Which of the following compounds have the same number of lone pairs on their central atom?
- (I) XeF_5^- (II) BrF_3
(III) XeF_2 (IV) H_3O^+
(V) XeO_6^{4-}
- (1) IV and V (2) I and III
(3) I and II (4) II, IV and V
30. How many σ bonds are there in P_4 , P_4O_6 and P_4O_{10} ?
- (1) 12, 6, 16
(2) 16, 6, 12
(3) 6, 12, 16
(4) 16, 16, 12

BIOLOGY

Comprehension for (Q.No. 31 to Q.No.33): All living organisms are made of cells. Some are unicellular and others are multicellular. But few structures are real exceptions in biology. Some organisms have cell wall but some do not. In genetic engineering virus are very important.

31. Gene transfer by the help of virus is called:

- (1) Transformation (2) Transduction
(3) Conjugation (4) Both (1) & (2)

32. Which of the following are exception of cell theory?

- (1) Bacteria (2) Amoeba
(3) Rickettsia (4) Virus

33. Which of the following organisms have cell membrane but never have cell wall?

- (1) Cyanobacteria (2) Virus
(3) Mycoplasma (4) Eubacteria

34. A process that starts with activity of most abundant enzyme in the world and results in release of CO₂ is:

- (1) Cellular respiration
(2) Photosynthesis
(3) Alcoholic fermentation
(4) Photorespiration

35. The carrying capacity of a population is determined by its

- (1) Population growth rate
(2) Birth rate
(3) Death rate
(4) Limiting resource

36. Match the following:

	Column-I		Column-II
(a)	Simple cuboidal epithelium	(i)	Eustachian tube
(b)	Simple columnar epithelium	(ii)	Terminal bronchioles

(c)	Simple squamous epithelium	(iii)	Thyroid vesicle
(d)	Ciliated columnar epithelium	(iv)	Gastric gland

- (1) (a)-(iii), (b)-(iv), (c)-(ii), (d)-(i)
(2) (a)-(iv), (b)-(ii), (c)-(iii), (d)-(i)
(3) (a)-(ii), (b)-(iii), (c)-(i), (d)-(iv)
(4) (a)-(iii), (b)-(ii), (c)-(iv), (d)-(i)

37. Which one of the following is wrongly matched?

- (1) Root pressure – Guttation
(2) Puccinia – Smut
(3) Cassia – Imbricate aestivation
(4) Both (1) and (3)

38. Our throat divides into two separate tubes: the windpipe and the gullet. What prevents food from entering the windpipe?

- (1) Tongue (2) Trachea
(3) Epiglottis (4) Esophagus

39. Which of the following is a merit in the Bentham and Hooker's system of classification?

- (1) The placement of order - Ranals in the beginning
(2) The placement of family - Asteraceae in the beginning of Gamopetalae
(3) Closely related families are placed apart
(4) All of the above

40. The polypeptide or protein part of the enzyme is called

- (1) Holoenzyme
(2) Apoenzyme
(3) Prosthetic group
(4) Coenzyme

41. For a critical study of secondary growth in plants, which one of the following pairs is suitable?

- (1) Sugarcane and sunflower
- (2) Teak and pine
- (3) Deodar and fern
- (4) Sunflower and deodar

Comprehension for (Q.No.42 & Q.No.43): A simple tissue is made of cells similar in structure and function, and the tissues made of many different types of cells are called complex tissues. Simple tissues are parenchyma, collenchyma and sclerenchyma and the complex tissues are exemplified by xylem and phloem.

42. The most common simple tissue present in all plants is:

- (1) Parenchyma
- (2) Collenchyma
- (3) Sclerenchyma
- (4) Fibres

43. Which tissue is often contain chloroplast but this tissue is not present in monocots?

- (1) Parenchyma
- (2) Sclerenchyma
- (3) Phloem parenchyma
- (4) Collenchyma

44. De Vries gave his mutation theory on organic evolution while working on

- (1) *Althea rosea*
- (2) *Pisum sativum*
- (3) *Oenothera lamarckiana*
- (4) Both (1) and (2)

45. A health disorder that results from the deficiency of thyroxin in adults and characterized by (i) a low metabolic rate, (ii) increase in body weight and (iii) tendency to retain water in tissues is

- (1) Cretinism
- (2) Myxedema

(3) Hypothyroidism

(4) Simple goitre

46. Which one of the following is a matching pair of a drug and its category?

- (1) Lysergic acid dimethyl amide – narcotic
- (2) Heroin – psychotropic
- (3) Benzodiazepines – pain killer
- (4) Amphetamines – stimulant

47. Two pea plants were subjected cross pollination. Of the 183 plants produced in the next generation, 94 plants were found to be tall and 89 plants were found to be dwarf. The genotypes of the two parental plants are likely to be

- (1) Tt and Tt
- (2) TT and TT
- (3) tt and tt
- (4) Tt and tt

48. Which one of the following pairs is wrongly matched?

- (1) Agave Bulbils
- (2) Water hyacinth Runner
- (3) Bryophyllum Leaf buds
- (4) PenicilliumConidia

49. The thalamus is convex or conical; ovary develops at its tops while stamens, petals and sepals are borne successively below. This kind of floral arrangement is called

- (1) Hypogamous and ovary inferior
- (2) Hypogamous and ovary superior
- (3) Perigamous and ovary inferior
- (4) Perigamous and ovary superior

50. Which one of the following is commonly used in transfer of foreign DNA into crop plants?

- (1) *Agrobacterium tumefaciens*
- (2) *Penicillium expansum*
- (3) *Meloidogyne incognita*
- (4) *Trichoderma harzianum*

MATHEMATICS

31. The locus of the mid-point of the chord of contact of tangents drawn from points lying on the straight line $4x - 5y = 20$ to the circle $x^2 + y^2 = 9$ is
- (1) $20(x^2 + y^2) + 36x - 45y = 0$
 - (2) $20(x^2 + y^2) - 36x + 45y = 0$
 - (3) $36(x^2 + y^2) - 20x + 45y = 0$
 - (4) $36(x^2 + y^2) + 20x - 45y = 0$
32. The total number of ways in which 5 balls of different colours can be distributed among 3 persons so that each person gets at least one ball is
- (1) 75
 - (2) 243
 - (3) 210
 - (4) 150
33. If $\lim_{x \rightarrow \infty} \left(\frac{x^2 + x + 1}{x + 1} - ax - b \right) = 4$, then
- (1) $a = 1, b = 4$
 - (2) $a = 2, b = -3$
 - (3) $a = 1, b = -4$
 - (4) $a = 2, b = 3$
34. The ellipse $E_1: \frac{x^2}{9} + \frac{y^2}{4} = 1$ is inscribed in a rectangle R whose sides are parallel to the coordinate axes. Another ellipse E_2 passing through the point $(0, 4)$ circumscribes the rectangle R . The eccentricity of the ellipse E_2 is
- (1) $\frac{\sqrt{2}}{2}$
 - (2) $\frac{\sqrt{3}}{2}$
 - (3) $\frac{3}{4}$
 - (4) $\frac{1}{2}$
35. Let z be a complex number such that the imaginary part of z is nonzero and $a = z^2 + z + 1$ is real. Then a cannot take the value
- (1) -1
 - (2) $\frac{1}{3}$
 - (3) $\frac{1}{2}$
 - (4) $\frac{3}{4}$
36. The point P is the intersection of the straight line joining the points $Q(2, 3, 5)$ and $R(1, -1, 4)$ with the plane $5x - 4y - z = 1$. If S is the foot of the perpendicular drawn from the point $T(2, 1, 4)$ to QR , then the length of the line segment PS is
- (1) $\frac{1}{\sqrt{2}}$
 - (2) $\sqrt{2}$
 - (3) 2
 - (4) $2\sqrt{2}$
37. Solve:
- $$\frac{(\sin 7x + \sin 5x) + (\sin 9x + \sin 3x)}{(\cos 7x + \cos 5x) + (\cos 9x + \cos 5x)}$$
- (1) $\tan 7x$
 - (2) $\tan 6x$
 - (3) $\sin 6x$
 - (4) $\sin 7x$
38. If the line $x - 1 = 0$ is the directrix of the parabola $y^2 - kx + 8 = 0$, then one of the values of k is
- (1) 6
 - (2) 8
 - (3) 4
 - (4) 7
39. A committee of 5 is to be formed from 9 ladies and 8 men. If the committee commands a lady majority, then the number of ways this can be done is
- (1) 3486
 - (2) 3360
 - (3) 1008
 - (4) 2968
40. If in the expansion of $(1 + x)^m (1 - x)^n$, the coefficients of x and x^2 are 3 and -6 respectively, then m is
- (1) 6
 - (2) 12
 - (3) 9
 - (4) 14
41. If the function $f(x) = 2x^3 - 9ax^2 + 12a^2x + 1$, where $a > 0$, attains its maximum and minimum values at p and q respectively such that $p^2 = q$, then a equals
- (1) $\frac{1}{2}$
 - (2) 2
 - (3) 1
 - (4) 3

42. Number of real solution $\sqrt{x^2 + 3x + 2} + |x - 4| = 0$ is

- (1) 0
- (2) 1
- (3) 2
- (4) Infinite

43. If $x^2 - 2x \cos\theta + 1 = 0$ then the value of $x^{2n} - 2x^n \cos n\theta + 1$ is equal to

- (1) $\cos 2n\theta$
- (2) $\sin 2n\theta$
- (3) 0
- (4) some real number > 0

44. Two contestants play a game as follows each is asked to select a digit from 3, 4, 5, 6, 7, 8. If the two digits match they both win a prize. The probability that they will win a prize in a single trial is

- (1) $\frac{1}{36}$
- (2) $\frac{1}{3}$
- (3) $\frac{1}{6}$
- (4) $\frac{2}{3}$

45. The complete solution set of $\frac{5^{x-1}}{4^{x+1}} \geq 0$ is

- (1) $(-\infty, 0]$
- (2) \mathbb{R}
- (3) $(-\infty, -1] \cup [1, \infty)$
- (4) $[0, \infty)$

46. If all roots of the equation, $z^3 + az^2 + bz + c = 0$ ($a, b, c \in \mathbb{R}$) are of unit modulus, then

- (1) $|a| \leq 3$
- (2) $|b| < 3$
- (3) $|c| > 1$
- (4) $|b| > 3$

47. It is given that,

$$\frac{\log \sin^2 \alpha}{4x + y + 7z} = \frac{\log \cos \beta}{-x + y - 2z} = \frac{\log \sin \gamma}{x - 6y + 3z}$$

(wherever defined).

On the basis of above information, answer the following question:

If $\alpha, \beta, \gamma \in [0, 2\pi]$ such that $(\alpha + \beta + \gamma)$ is maximum then $\sum \tan \frac{\alpha}{8} \tan \frac{\beta}{8}$ is equal to

- (1) 1
- (2) 0
- (3) -1
- (4) $\sqrt{3}$

48. Consider the algebraic expression

$$(x + 1)(x - 2)(x + 3)(x - 4)\dots\dots(x - 100).$$

On the basis of above information, answer the following question :

Coefficient of x^{100} is equal to

- (1) 50
- (2) 1
- (3) 100
- (4) 101

49. The point (α^2, α) is a point in the angle between the lines, $x + 2y - 3 = 0$ and $2x - 5y + 2 = 0$ containing the origin if:

- (1) $\alpha \in (1, 2)$
- (2) $\alpha \in \left(-3, \frac{1}{2}\right)$
- (3) $\alpha \in \left(\frac{1}{2}, 1\right)$
- (4) $\alpha \in (-1, 3)$

50. Let function $f : \mathbb{R} \rightarrow \mathbb{R}$ be defined by $f(x) = 15x + \sin(x^{15})$ for $x \in \mathbb{R}$ then f is

- (1) one-to-one not onto
- (2) onto but not one-to-one
- (3) one-to-one and onto
- (4) many-to-one



END OF THE EXAM