EHF

LEARNING FOR LIFE

EDUHEAL FOUNDATION

CLASS 11

LEVEL – 1

Set A1

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NATIONAL IIT-PMT OLYMPIAD (NIPO)

EHF NATIONAL IIT-PMT OLYMPIAD

Name : .....

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BSE international finance olympiad (BIFO)

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Level - 1 : All Level-1 successful* participants will get certificate, apititude 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 EHFs 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

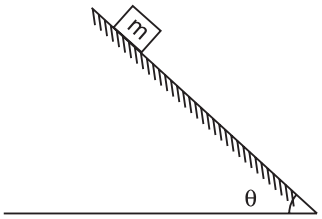
PHYSICS

1. A particle of mass M has half the kinetic energy of another particle of mass $\frac{M}{2}$. If the speed of the heavier particle is increased by 2 ms^{-1}, its new kinetic energy equals the original kinetic energy of the lighter particle. What is the original speed of the heavier particle?

(1) $2(1+\sqrt{2})\,ms^{-1}$ (2) $2(1+2\sqrt{2})\,ms^{-1}$

(3) $(2\sqrt{2}+1)\,ms^{-1}$ (4) $(2\sqrt{2}-1)\,ms^{-1}$

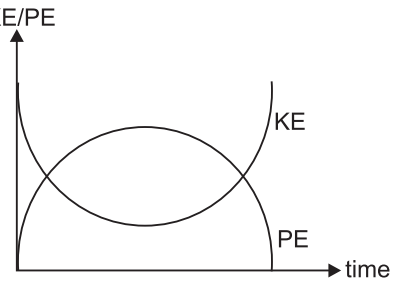
2. In the figure shown find frictional force acting on the block of mass *m*. Coefficient of friction between surface and block is μ and $\tan\theta < \mu$.

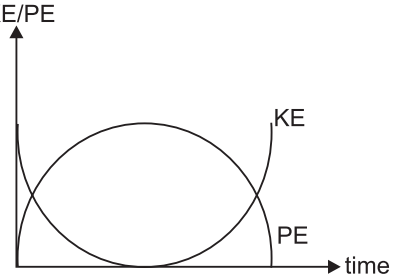


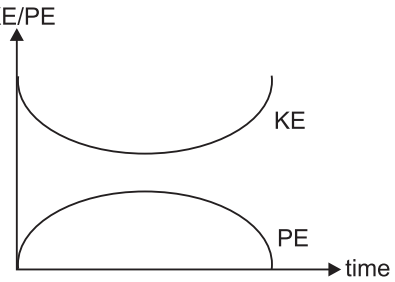
(1) $mg\sin\theta$ (2) $\mu mg\cos\theta$

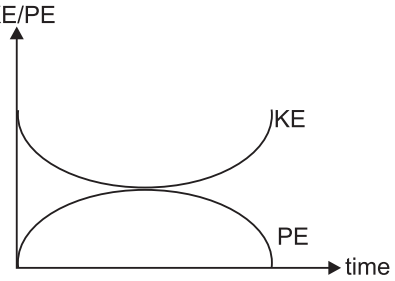
(3) $\mu mg\tan\theta$ (4) zero

3. A particle is projected at an angle θ = 30° with the horizontal. Which of the following curves best represents the variation of kinetic energy and gravitational potential energy as a function of time? (Take the horizontal as the reference level for the gravitational potential energy.)

(1)


(2)


(3)


(4)


4. A particle moving on the circumference of a circle of radius *r* describes an angle θ. The displacement and distance moved by particle are

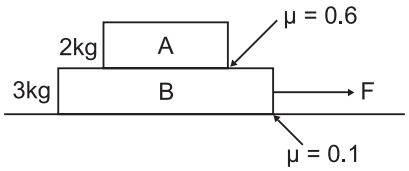
(1) r, $r\theta$

(2) $2r\sin(\theta/2)$, $r\theta$

(3) $r\sin\theta$, $r(\theta/2)$

(4) $2r$, $2r\sin\theta$

5. In the figure shown below friction force between A and B is f_1 and between B and ground is f_2. If $f_1 = 2f_2$ then find F:



(1) 20 N (2) 25 N

(3) 30 N (4) 40 N

6. A particle starts moving from rest on a straight line with a constant acceleration 2 m/s^2. What is distance travelled by particle when its velocity becomes 4 m/s?

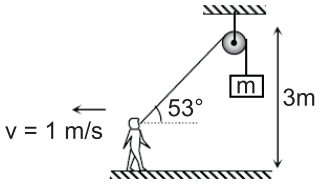
(1) 4 m

(2) 2 m

(3) 1 m

(4) 0 m

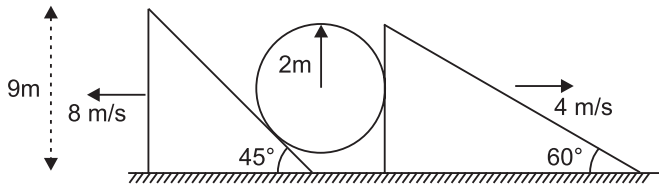
7. A boy is running at a constant speed v = 1 m/s leftward without slipping on a rough horizontal surface. He is holding string which is connected to a block of mass m = 2kg as shown in the figure. Find out the power developed by internal forces of the boy in the situation shown in the figure. (Take g = 10 m/s^2)



(1) 12.2 W (2) 12 W

(3) 12.8 W (4) 11.8 W

8. As shown in diagram, two wedges of same height are placed on a smooth surface, and moving in opposite direction with constant velocity. A sphere is placed in such a way that the contact between wedges and sphere is maintained throughout motion. Velocity of sphere will be



(1) $2\sqrt{10}$ (2) 12

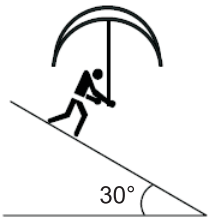
(3) 4 (4) $4\sqrt{10}$

9. An elevator of mass M is accelerated upwards by applying a force F. A mass m initially situated at a height of 1 m above the floor of the elevator is falling freely. It will hit the floor of the elevator after a time equal to:

(1) $\sqrt{\frac{2M}{F+mg}}$ (2) $\sqrt{\frac{2M}{F+Mg}}$

(3) $\sqrt{\frac{2M}{F}}$ (4) $\sqrt{\frac{2m}{F}}$

10. A man is coming down an incline of angle 30°. When he walks with speed $2\sqrt{3}$ m/s, he has to keep his umbrella vertical to protect himself from rain. The actual speed of rain is 5 m/s. At what angle with vertical should he keep his umbrella when he is at rest so that he does not get drenched?



(1) 0° (2) 30°

(3) 37° (4) 53°

11. A free charged particle moves through a magnetic field. The particle may undergo a change in

(1) speed

(2) energy

(3) direction of motion

(4) both (1) and (2)

12. A rectangular coil of copper wires is rotated in a magnetic field. The direction of the induced current changes once in each

(1) two revolutions

(2) one revolution

(3) half revolution

(4) three revolutions

13. Which power plant works on the basis of gravity of earth?

(1) Geothermal

(2) Nuclear power

(3) Hydropower

(4) Both (2) and (3)

14. Two bulbs marked 200 watt-250 volts and 100 watt-250 volts are joined in series to 250 volts supply. Power consumed in circuit is

(1) 33 watt (2) 67 watt

(3) 100 watt (4) 87 watt

15. The far point of a myopic person is 80 cm in front of the eye. What is the nature and power of the lens required to correct the problem?

(1) A convex lens of power –1.25 D

(2) A concave lens of power –1.15 D

(3) A concave lens of power –1.25 D

(4) A convex lens of power –4 D

16. The pH of a mixture obtained by mixing 100 ml, 0.1 M H_3PO_4 with 100 ml of 0.3 M Na_3PO_4, is (For H_3PO_4; $Ka_1 = 1 \times 10^{-4}$, $Ka_2 = 1 \times 10^{-8}$, $Ka_3 = 1 \times 10^{-11}$ and $\log_{10} 3 = 0.47$)

(1) 7.53

(2) 10.53

(3) 11.47

(4) 4.47

17. If the radius of 1st Bohr orbit of hydrogen atom is r, the de Broglie wavelength of an electron in the 2nd Bohr orbit of hydrogen atom is

(1) $2\pi r$

(2) $4r$

(3) $2r$

(4) $4\pi r$

18. In a sample of hydrogen atoms, all atoms are originally in 4th excited state. The minimum number of H–atoms that should be present in this sample in order to show all possible spectral lines are

(1) 04

(2) 05

(3) 06

(4) 03

19. Which of the following molecule is expected to be linear as well as polar?

(1) BF_3

(2) SiO_2

(3) CO_2

(4) XeFCl

20. When NH_3 reacts with HCl then which of the following option correctly represents the change in H–N–H bond angle?

(1) Around 1º

(2) Around 4º

(3) Around 2.5º

(4) Around 5º

21. Lithium's first and second ionization energies are 519 kJ/mol and 7300 kJ/mol respectively. Element X has a first ionization energy of 590 kJ/mol and a second ionization energy of 1150 kJ/mol. Element X is most likely to be :

(1) Oxygen

(2) Sodium

(3) Calcium

(4) Xenon

22. A real gas that obeys the equation of state $p(V - nb) = nRT$, where b and R constants. If the pressure and temperature are such that $V_m = 9b$. The value of the compression factor is

(1) $\frac{9}{10}$

(2) $\frac{10}{9}$

(3) $\frac{9}{8}$

(4) $\frac{8}{9}$

23. A mixture of CO and CO_2 is found to have a density of 1.70 g/L at STP. The mole fraction of CO in the mixture is

(1) 0.37

(2) 0.40

(3) 0.30

(4) 0.50

24. A solution of density 2.00 g/cm^3 contains solute X (MW = 80.0). The solution is analyzed to have 60.0% X by weight. What is the molarity of solution?

(1) 24.0 M

(2) 12.5 M

(3) 15.0 M

(4) 12.0 M

25. The wavelength of photon emitted when an electron jumps from a 4*d* orbital to a 2*p* orbital in Hydrogen atom is [The Rydberg constant is $1.097 \times 10^7\ m^{-1}$]

(1) 656.3 nm (2) 486.2 nm

(3) 364.6 nm (4) 2.057×10^{-3} nm

26. A mixture of 50 ml of H_2 and 50 ml of O_2 is allowed to effuse through an effusometer till the residual gas mixture occupies 90 ml. The volume of H_2 gas diffused is

(1) 2 ml (2) 8 ml

(3) 5 ml (4) 4 ml

27. An element react with oxygen to give a compound with high melting points. This compound is also soluble in water. The element is likely to be:

(1) Calcium (2) Carbon

(3) Silicon (4) Iron

28. An organic compound A having molecular formula $C_2H_4O_2$ reacts with Sodium metal Na evolves a gas B which readily catches fire. A also reacts with Ethanol in the presence of concentrated Sulphuric acid to form a sweet smelling substance C in making perfumes. Identify the compounds A, B and C.

(1) A = Ethanoic acid, B = H_2, C = Ester

(2) A = Methanoic acid, B = H_2O, C = Ethanol

(3) A = Ethanoic acid, B = HCl, C = Ester

(4) A = Acetic acid, B = H_2S, C = Aldehyde

29. What is incorrect about CuO, H_2, Cu and H_2O in a reaction?

$$CuO + H_2 \rightarrow Cu + H_2O$$

(1) Reduction of CuO takes place.

(2) Hydrogen is reducing agent.

(3) Hydrogen is reduced to H_2O.

(4) All the above

30. 10 ml of a gaseous hydrocarbon is exploded with 100 ml of oxygen. The residual gas on cooling is found to measure 95 ml. On passing through caustic soda solution, volume decreases by 20 ml and remaining gas is absorbed by alkaline pyrogallol. The formula of the hydrocarbon is

(1) CH_4 (2) C_2H_6

(3) C_2H_4 (4) C_2H_2

BIOLOGY

31. The intercellular material (matrix) of cartilage is

(1) Solid and nonpliable

(2) Solid and pliable

(3) Semisolid and nonpliable

(4) Semisolid and pliable

32. Which one is a mismatch pairing?

(1) *Petromyzon* – Cyclostomata

(2) *Branchiostoma* – Urochordata

(3) *Pterophyllum* – Osteichthyes

(4) *Ichthyophis* – Amphibia

33. Which of the following is **not** a matching pair of an animal with a certain feature ?

(1) *Obelia* : Metamerism

(2) *Ctenophores* : Bioluminiscence

(3) *Planaria* : High regeneration capacity

(4) *Ascaris* : Pseudocoelom

34. Plants can show mitotic division in

(1) Only haploid cells

(2) Only diploid cells

(3) Both haploid and diploid cells

(4) Neither haploid nor diploid cells

35. Which one of the following terms is correctly matched with their correct description?

	Term	Description
(1)	Taxon	Provide the index to the plant species found in a particular area
(2)	Flora	Contains the actual account of habitat and distribution of plants of a given area
(3)	Monograph	Collection of preserved plants and animals
(4)	Catalogues	Contain information on any one taxon

36. Desmosomes are usually found in

(1) Epithelial tissue
(2) Muscular tissue
(3) Nervous tissue
(4) All of these

37. Which is the correct sequence of the path of water current flowing in *Spongilla*?

(1) Osculum → Spongocoel → Ostium
(2) Osculum → Ostium → Spongocoel
(3) Spongocoel → Osculum → Ostium
(4) Ostium → Spongocoel → Osculum

38. For identification of an organism through key usually

(1) One similar character is used
(2) Two contrasting characters are used
(3) Many similar characters are used
(4) Only one statement called lead is used

39. Comparing small and large cells, which statement is correct?

(1) Small cells have a small surface area per volume ratio.
(2) Exchange rate of nutrients is fast with large cells.
(3) Exchange rate of nutrients is slow with small cells.
(4) Small cells have a large surface area per volume ratio.

40. Which one is a false statement for *Periplaneta*?

(1) It is uricotelic in nature.
(2) The sclerites are joined by arthrodial membrane.
(3) Hepatic caeca is at the junction of mid gut and hind gut.
(4) Malpighian tubules are associated with the excretion.

41. Protofilaments are microtubule consists of hundreds of thousands of tubulin subunit usually arranged in:

(1) 10 columns
(2) 12 columns
(3) 13 columns
(4) 14 columns

42. Identify the plant parts whose transverse sections show a clear and prominent pith.

(1) Dicot stem and monocot stem
(2) Dicot stem and dicot root
(3) Dicot root and monocot root
(4) Dicot stem and monocot root

43. Which one of the animal phyla does not possess a coelom?

(1) Mollusca
(2) Platyhelminthes
(3) Annelida
(4) Echinodermata

44. If the margin of thalamus grows upward enclosing the ovary completely and getting fused with it, the other parts of flower arise above the ovary, the flower is said to be

(1) Epigynous
(2) Perigynous
(3) Hypergynous
(4) Hypogynous

45. The role of HCl in our stomach is

(1) Acidifies food for the action of pepsin.
(2) Digestion of fat
(3) Digestion of protein
(4) Both (2) and (3)

46. A student identified the various parts of an embryo of a gram seed and listed them as given below:

I. Testa II. Plumule
III. Radicle IV. Cotyledon
V. Tegmen

Out of these the actual parts of the embryo are

(1) I, II, III
(2) II, III, IV
(3) III, IV, V
(4) I, III, V

47. Name the process in which a harmful chemical enters the food chain and gets concentrated at each level in the food chain.

(1) Concentration

(2) Biomagnification

(3) Expansion

(4) All of the above

48. In reflex action, the reflex arc is formed by _____.

(1) muscles – effector – brain

(2) receptor – spinal cord – muscles

(3) muscles – receptor – brain

(4) spinal cord – brain – muscles

49. Students A, B and C were given five raisins each of equal weight. The raisins were soaked in distilled water at room temperature. A removed the raisins after 20 minutes, B after two hours and C after 40 minutes. If P_A, P_B and P_C denote percentage absorption of water obtained by students A, B and C respectively, then

(1) $P_A > P_B > P_C$.

(2) $P_A < P_B < P_C$.

(3) $P_A < P_B > P_C$.

(4) $P_B < P_A > P_C$.

50. Name an organ which is part of two body systems.

(1) Intestine

(2) Pancreas

(3) Lungs

(4) Both (1) and (2)

MATHEMATICS

31. If the perpendicular from origin to the line $y = mx + c$ meet at a point $(-1, 2)$. Then the value of $m + c$ is

(1) 2

(2) 3

(3) 4

(4) 5

32. If the equation $Z^2 + Z + \alpha = 0$ has a purely imaginary root and α lies on the circle $|Z| = 1$, then the value of $(1 + \alpha + \bar{\alpha})$ is

(1) $\sqrt{2}$

(2) $\sqrt{5}$

(3) $\sqrt{3}$

(4) $\sqrt{6}$

33. The equation of circle which touches axis of y at the origin and passes through $(3, 4)$ is

(1) $3(x^2 + y^2) - 25x = 0$

(2) $2(x^2 + y^2) - 3x = 0$

(3) $4(x^2 + y^2) - 25x = 0$

(4) $4(x^2 + y^2) - 25x + 10 = 0$

34. The graph of the function $y = 16x^2 + 8(a + 2)x - 3a - 2$ is strictly above the x-axis, then number of integral values of a is

(1) 6

(2) 5

(3) 4

(4) 3

35. $\sum_{k=1}^{\infty}\left(\frac{1-k}{2^k}\right)$ is equal to

(1) –3

(2) –1

(3) –8

(4) –4

36. If $y = x^{3/4}(x^{-1/4} + 1)(x^{-1/2} + 1)(x^{1/4} - 1)$, then $\frac{dy}{dx}$ is equal to

(1) 1

(2) –1

(3) $\frac{3}{4}x^{-1/4}$

(4) $\frac{5}{4}x^{-1/4}$

37. If $\tan(\theta - \alpha) = a$ and $\tan(\theta + \alpha) = b$, then $\tan 2\alpha$ equals to

(1) $\frac{a+b}{1-ab}$

(2) $\frac{a-b}{1+ab}$

(3) $\frac{b-a}{1-ab}$

(4) $\frac{b-a}{1+ab}$

38. The number of numbers from the set of first 500 natural numbers which are multiples of 3 or 5 but not of 7 is

(1) 210

(2) 200

(3) 190

(4) 271

39. The circumcentre of the triangle formed by the line $2x + 3y = 12$ and the co-ordinate axes will be

(1) (3, 4)

(2) (6, 2)

(3) (0, 0)

(4) (3, 2)

40. Let $f(x) = x^2 + bx + c$; where $b, c \in R$. If $f(x)$ is a factor of both $x^4 + 6x^2 + 25$ and $3x^4 + 4x^2 + 28x + 5$, then the least value of $f(x)$ is

(1) 2

(2) 3

(3) 4

(4) 6

41. $\sum_{r=1}^{\infty} \frac{r^3 + (r^2+1)^2}{(r^4 + r^2 + 1)(r^2 + r)}$ is equal to

(1) 4

(2) 2

(3) 3/2

(4) 1

42. If H is the orthocentre of acute angled triangle ABC, R is circumradius and P = AH + BH + CH, then

(1) $R > P \geq 4R$

(2) $R < P \leq 4R$

(3) $2R < P \leq 5R$

(4) $2R < P \leq 3R$

43. $\log_{n^p} m^q$ is equal to (where $m = n^k$)

(1) $\frac{pk}{q}$ (2) $\frac{qk}{p}$

(3) $\frac{pq}{k}$ (4) $\frac{p^2}{k}$

44. In a competition, one mark is awarded for every correct answer and half mark is deducted for every wrong answer. Jayanthi answered 120 questions and got 90 marks. How many questions did she answer correctly?

(1) 110 (2) 95

(3) 100 (4) 120

45. The complex number $3 + 4i$ is rotated about origin by an angle of $\frac{\pi}{2}$ in anti-clockwise direction and then stretched 2-times. The complex number corresponding to new position is (where $i = \sqrt{-1}$)

(1) $8 - 6i$

(2) $6 - 8i$

(3) $-8 + 6i$

(4) $6 + 8i$

46. If the roots of the polynomial $2x^3 - 4x^2 + 7x - 5 = 0$ are a, b, c, then find the value of

$$\frac{1}{(b-4)(a-2)+2a-4}+\frac{1}{(b-4)(c-2)+2c-4}+\frac{1}{(a-4)(c-2)+2c-4}$$

(1) $\frac{4}{5}$

(2) $\frac{8}{9}$

(3) $\frac{5}{9}$

(4) $\frac{3}{5}$

47. Find the polar representation of $(i - \sqrt{3})$.

(1) $2\cos\left(\frac{11\pi}{9}\right)+i\sin\left(\frac{11\pi}{9}\right)$

(2) $2\sin\left(\frac{6\pi}{7}\right)+i\cos\left(\frac{6\pi}{7}\right)$

(3) $2\cos\left(\frac{5\pi}{6}\right)+i\sin\left(\frac{5\pi}{6}\right)$

(4) $2\sin\left(\frac{5\pi}{6}\right)+i\cos\left(\frac{5\pi}{6}\right)$

48. A man receives ₹ 60 for the first week and ₹ 3 more each week than the preceeding week. How much does he earns by the 20th week?

(1) ₹ 1,760

(2) ₹ 1,780

(3) ₹ 1,770

(4) ₹ 1,790

49. Let $p, q, a \in R$ such that $p^2 + q^2 - 2p = 0$, then the minimum value of $\sqrt{(p-a)^2+(a+q-4)^2}$ is

(1) 1

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

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

(4) 2

50. Find the value of k for which the system of equations have infinitely many solutions:

$$x - ky = 2,\ 3x + 6y = -5$$

(1) -3 (2) -2

(3) -4 (4) -5

END OF THE EXAM