# Talent Search Exam. 2022

TEST CODE **1109**

*for class XI (Non-Medical)*

BOOKLET **D**

**Duration : 1.30 Hours** | **Max. Marks : 240**

***Please read the instructions carefully. You are alloted 5 minutes specifically for this purpose.***

## INSTRUCTIONS

### A. General :

1. This booklet is your Question Paper. DO NOT break seal of Booklet until the invigilator instructs to do so. Total Questions to be Attempted 60: **Chemistry : 20, Mathematics : 20 Questions, Physics : 20.**
2. The Answer Sheet is provided to you separately which is a machine readable Optical Response Sheet (ORS). You have to mark your answers in the ORS by darkening bubble, as per your answer choice, by using black & blue ball point pen.
3. Things NOT ALLOWED in EXAM HALL : Blank Paper, clipboard, log table, slide rule, calculator, camera, mobile and any electronic or electrical gadget. If you are carrying any of these then keep them at a place specified by invigilator at your own risk.
4. Do not use white-fluid or any other rubbing material on answer sheet. Before handing over the answer sheet to the invigilator, candidate should check that **Roll No, Test code and Book Code** have been filled and marked correctly. Immediately after the prescribed examination time is over, the **Answer sheet is to be returned to the invigilator.**

### B. Filling the Answer Sheet :

5. On Side-1 of Answer Sheet write your Name and Roll Number in the respective boxes. Do not write anything on Side-2.
6. **Marking Scheme:**
   a. If darkened bubble is RIGHT answer : 4 Marks.
   b. If no bubble is darkened in any question: No Mark.
   c. If darkened bubble is WRONG answer: –1 Mark (Minus One Mark).
7. Think wisely before darkening bubble as there is negative marking for wrong answer.

**PROCEDURE OF FILLING UP THE ANSWERS IN ANSWER SHEET**

| Avoid Improper Marking | Proper Marking |
|---|---|
|  Partially Filled  Lightly Filled  Tick-Cross Marked |  Fully darken |

**Name of the candidate (In Capital Letters)**

**Roll Number**

| | | | | |
|---|---|---|---|---|
| | | | | |

**I have read all the instruction and shall abide by them.**

.....

**(Signature of the candidate)**

**I have verified all the information filled in by the candidate.**

.....

**(Signature of the Invigilator)**

**No One is Perfect**
**- that's why Pencils have Erasers.**

# [ CHEMISTRY ]

1. $NaClO_3$ is used, even in spacecrafts, to produce $O_2$. The daily consumption of pure $O_2$ by a person is 492 L at 1 atm, 300 K. If the amount of $NaClO_3$ (in g) which is required to produce $O_2$ for the daily consumption of a person at 1 atm, 300 K is X. Then the value of $\frac{X}{100}$ is (assume Fe(s) is taken in excess)

$NaClO_3(s) + Fe(s) \rightarrow O_2(g) + NaCl(s) + FeO(s)$

$R = 0.082\ L\ atm\ mol^{-1}\ K^{-1}$

(a) 15.20 (b) 20.00

(c) 25.30 (d) 21.30

2. If the volume (mL) of water added to 100 mL 80% by weight HCl solution (d = 1.5 g/mL) to make it a solution of 40% by weight of density = 1.2 g/mL is X. The value of $\frac{X}{5}$ is:

(a) 20 (b) 30

(c) 10 (d) 35

3. $SO_3$ can be prepared by the following sequence of reactions

$S_8 + 8O_2 \rightarrow 8SO_2$, 50% yield (Reaction I)

$2SO_2 + O_2 \rightarrow 2SO_3$, 100% yield (Reaction II)

A sample containing 50% by mass of each $S_8$ and $O_2$ is taken in the initial reaction mixture. If the sum of weights of reactants initially taken to obtain 320 g of $SO_3$ is x g (for reaction I) then, value of $\frac{x}{16}$ is (yield of reactions are mentioned):

(a) 22 (b) 32

(c) 23 (d) 34

4. x gram sample of $KClO_3$ gives y ml of $O_2$ at STP by $2KClO_3 \xrightarrow{\Delta} 2KCl + 3O_2$. Percentage purity of $KClO_3$ sample will be (Take, molar mass of $KClO_3$ = M g/mol):

(a) $\frac{M+y}{336x}$

(b) $\frac{M-y}{336x}$

(c) $\frac{My}{336x}$

(d) $\frac{Mx}{336y}$

5. The nucleus of an atom is located at x = y = z = 0. If the probability of finding an s-orbital electron in a tiny volume around x = P, y = z = 0 is $7 \times 10^{-4}$. The probability of finding of electron in the same sized volume around z = P, x = y = 0:

(a) $14 \times 10^{-4}$ (b) $7 \times 10^{-14}$

(c) $7 \times 10^{-4}$ (d) Data insufficient

6. For any given series of spectral lines of atomic hydrogen, let $\Delta\bar{v} = \bar{v}_{max} - \bar{v}_{min}$ be the difference in maximum and minimum frequencies in $cm^{-1}$. The ratio $\bar{v}_{Lyman} / \bar{v}_{Balmer}$ is:

(a) 9 : 4 (b) 27 : 5

(c) 4 : 1 (d) 5 : 4

7. Consider the reactions:

**Reaction I**

$$SO_2 + \frac{1}{2}O_2 \rightarrow SO_3$$

**Reaction II**

$$SO_3 + \underset{\text{(Excess)}}{H_2O} \rightarrow H_2SO_4$$

**Reaction III**

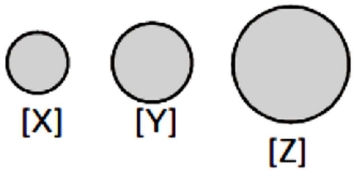
$$2H_2SO_4 \xrightarrow{\Delta} H_2S_2O_7 + H_2O$$

25.6 g of $SO_2$ and x g of $O_2$ react in reaction I and 35.6 g of $H_2S_2O_7$ is prepared in reaction III. The minimum value of x is:

(a) 3.40 (b) 5.40

(c) 4.50 (d) 6.40

8. The following sphere represents relative size of cations (not in order, not in scale) $Li^+$, $Ca^{2+}$ and $Al^{3+}$.




The correct order of magnitude of lattice energy of their fluorides is:

(a) X > Y = Z (b) X < Y < Z

(c) X > Z > Y (d) X < Z < Y

9. In the compound M–O–H, the M–O bond will ionize in aq. medium readily if:

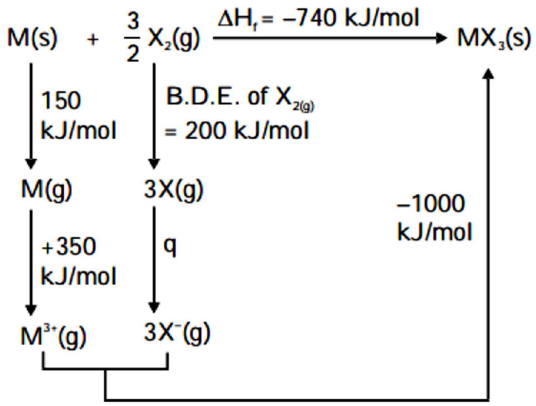
(a) $\Delta$ (E.N.) of M and O < $\Delta$ (E.N.) of O and H

(b) $\Delta$ (E.N.) of M and O = $\Delta$ (E.N.) of O and H

(c) $\Delta$ (E.N.) of M and O > $\Delta$ (E.N.) of O and H

(d) Cannot be predicated

10. Consider the following Born-Haber's cycle for formation of $MX_3(s)$.




Then calculate value $\frac{q_1}{50}$, here $q_1$ is electron affinity of X(g) in kJ/mol.

(a) 4.50 (b) 3.60

(c) 5.60 (d) 6.30

11. $IE_1$ (kJ/mole) of 2nd period elements are mentioned below with some blank/vacant data spaces:

| Li | Be | B | C | N | O | F | Ne |
|---|---|---|---|---|---|---|---|
| 520 | "P" | 800 | "Q" | 1402 | 1314 | "R" | 2080 |

Select correct number of statement(s) regarding above data table. (Consider all processes are gas phased).

(a) |EA| of $N^+$ is more than 1402 kJ/mol

(b) Value of "R" is more than 1402 kJ/mol

(c) Value of "P" is more than |EA| of $C^+$

(d) Value of "R" is less than 1402 kJ/mol

12. Which pair is not correct order of lattice energy?

(a) KCl > MgO (b) AlN > MgO

(c) CaO > BaO (d) $MgCO_3$ > $CaCO_3$

13. Lattice energy of $BeCO_3$(I) , $MgCO_3$(II) and $CaCO_3$(III) is in order:

(a) I < II < III (b) I > II > III

(c) I < III < II (d) II < I < III

14. Which will have the maximum value of electron affinity $O^x$ , $O^y$ and $O^z$ (x, y and z are 0, –1 and –2 respectively)?

(a) $O^x$

(b) $O^y$

(c) $O^z$

(d) All have equal

15. Assign true (T) or false (F) for the following statements and select correct option for your answer.

I. I.P. of $O_{(g)}$ is less than I.P. of $O^-_{(g)}$

II. I.P. of $Ne_{(g)}$ is greater than I.P. of $Ne^+_{(g)}$

III. E.A. of $Ne_{(g)}$ is greater than E.A. of $O_{(g)}$

IV. I.P. of $N_{(g)}$ is greater than I.P. $N^+_{(g)}$

(a) F, F, T, T (b) T, T, T, T

(c) T, T, T, F (d) F, T, F, T

16. Polarization involves the distortion of the shape of an anion by an adjacently placed cation. In this context, which of the following statements is correct?

(a) Maximum polarization is brought about by a cation of high charge

(b) Minimum polarization is brought about by a cation of low radius

(c) A large cation is likely to bring about a high degree of polarization

(d) The polarizing power of a cation is less than that of an anion

17. Which of the following has been arranged in order of increasing covalent character?

(a) KCl < $CaCl_2$ < $AlCl_3$ < $SnCl_4$

(b) $SnCl_4$ < $AlCl_3$ < $CaCl_2$ < KCl

(c) $AlCl_3$ < $CaCl_2$ < KCl < $SnCl_4$

(d) $CaCl_2$ < $SnCl_4$ < KCl < $AlCl_3$

18. Which one of the following statements is incorrect in relation to ionization enthalpy?

(a) Ionization enthalpy increases for each successive electron

(b) The greatest increase in ionization enthalpy in experienced on removal of electron from core noble gas configuration

(c) End of valence electrons is marked by a big jump in ionization enthalpy

(d) Removal of electron from orbitals bearing lower n value is easier than from orbital having higher n value

19. Which of the following metal requires radiation of the lowest wavelength to cause emission of electrons?

(a) Na (b) K

(c) Mg (d) Ca

20. Consider the following ionization reactions:

| Reactions | IE |
|---|---|
| I. $X(g) \longrightarrow X^{\oplus}(g) + e^-$ | $X_1$ |
| II. $Y(g) \longrightarrow Y^{\oplus}(g) + e^-$ | $Y_1$ |
| III. $Y^{\oplus}(g) \longrightarrow Y^{+2}(g) + e^-$ | $Y_2$ |
| IV. $Z(g) \longrightarrow Z^{\oplus}(g) + e^-$ | $Z_1$ |
| V. $Z^{\oplus}(g) \longrightarrow Z^{+2}(g) + e^-$ | $Z_2$ |
| VI. $Z^{+2}(g) \longrightarrow Z^{+3}(g) + e$ | $Z_3$ |

If $Y^{\oplus}$, $Y^{+2}$ and $Z^{+3}$ ion have zero electron.

Select the incorrect order of corresponding IE.

(a) $Y_1 > X_1 > Z_1$ (b) $Y_2 > Z_3 > Z_1$

(c) $Z_3 > Y_2 > X_1$ (d) $Z_3 > Z_2 > Y_2$

## [ MATHEMATICS ]

21. If $\alpha$, $\beta$ be the roots of the equation $x^2 + ax - \frac{1}{2a^2} = 0$, a being a real parameter then find the least value of $[\alpha^4 + \beta^4]$ (where [ . ] represents greatest integer function).

(a) 4 (b) 5

(c) 3 (d) 6

22. In $\Delta ABC$, the minimum value of $\frac{\sum \cot^2 \frac{A}{2} . \cot^2 \frac{B}{2}}{\prod \cot^2 \frac{A}{2}}$ is:

(a) 1 (b) 2

(c) 3 (d) Non existent

23. Number of roots of the equation $\cos^2 x + \frac{\sqrt{3}+1}{2}\sin x - \frac{\sqrt{3}}{4} - 1 = 0$ which lie in the interval $[-\pi, \pi]$ is:

(a) 2 (b) 4

(c) 6 (d) 8

24. Out of 800 boys in a school, 224 played cricket, 240 played hockey and 336 played basketball. Of the total, 64 played both basketball and hockey; 80 played cricket and basketball and 40 played cricket and hockey; 24 played all the three games. The number of boys who did not play any game is:

(a) 128 (b) 216

(c) 240 (d) 160

25. If $a \in I$ & $a^4 + a^2 + 1$ is prime. The number of possible values of a is:

(a) 0 (b) 1

(c) 2 (d) 3

26. Suppose that, $\log_{10}(x-2) + \log_{10} y = 0$ and $\sqrt{x} + \sqrt{y-2} = \sqrt{x+y}$. Then the value of (x + y), is:

(a) 2 (b) $2\sqrt{2}$

(c) $2 + 2\sqrt{2}$ (d) $4 + 2\sqrt{2}$

27. $\sum_{n=1}^{1023} \log_2\left(1 + \frac{1}{n}\right)$ is equal to:

(a) 8 (b) 9

(c) 10 (d) 12

28. Let $P_n(x)$ be a polynomial such that $P_n(x) = (x-n) \times P_{n-1}(x)$, $n \in N \cup \{0\}$ and $P_0(x) = x^{90} - x^{89} + x^{88} - x^{87} + \ldots + 1$. $P_{10}(0)$ is:

(a) A prime number

(b) A composite number

(c) A negative integer

(d) An even positive integer

29. Sum of all the solutions of the equation $1 + \cos x + \cos^2 x + \cos^3 x = 0$ in $\left[-\frac{7\pi}{4}, \frac{15\pi}{4}\right]$ is equal to:

(a) $2\pi$ (b) $3\pi$

(c) $4\pi$ (d) $\pi$

30. For all pairs of angles (A, B), measured in degrees such that sin A + sin B = $\sqrt{2}$ and cos A + cos B = $\sqrt{\sqrt{2}}$, both hold simultaneously. The smallest possible value of |A – B| in degrees is:

(a) 15 (b) 30

(c) 45 (d) 60

31. If P = $\operatorname{cosec}\frac{\pi}{8} + \operatorname{cosec}\frac{2\pi}{8} + \operatorname{cosec}\frac{3\pi}{8} + \operatorname{cosec}\frac{13\pi}{8} + \operatorname{cosec}\frac{14\pi}{8} + \operatorname{cosec}\frac{15\pi}{8}$ and Q = $8\sin\frac{\pi}{18}\sin\frac{5\pi}{18}\sin\frac{7\pi}{18}$, then value of P + Q is:

(a) 0 (b) 1

(c) 2 (d) 3

32. Let $f(\theta)=\sum_{r=1}^{9}(\sin(2r-1)\theta+\cos 2r\theta)$ and $\sin\frac{\pi}{18}=a$, then $f\left(\frac{\pi}{18}\right)$ is equal to:

(a) $\frac{1+a}{a}$

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

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

(d) $\frac{1-a}{a}$

33. If a < c < b then the roots of the equation $(a-b)^2x^2$ + 2(a + b – 2c)x + 1 = 0 are:

(a) Imaginary

(b) Real

(c) One real & imaginary

(d) Equal & imaginary

34. If exactly one root of the quadratic equation f(x) = $ax^2+bx+c=0$ is at infinity then:

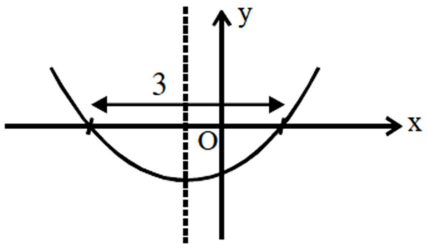
(a) a tends to zero

(b) b tends to zero

(c) b must not be zero

(d) Both (a) and (c)

35. If graph of f(x) = $x^2+bx+c$ is drawn in adjacent diagram, where b, $c\in I$, then number of such quadratic equation f(x) = 0 is:




(a) 1 (b) 2

(c) 3 (d) 4

36. The value of 'a' for which the equations $x^7+ax^2+3=0$ and $x^8+ax^3+3=0$ have a common root, can be

(a) 1 (b) –2

(c) –3 (d) –4

37. Consider the following two statements.

$S_1$ : All cyclic quadrilaterals ABCD satisfy $\tan\frac{A}{2}\tan\frac{B}{2}\tan\frac{C}{2}\tan\frac{D}{2}=1$

$S_2$ : All trapeziums ABCD satisfy $\tan\frac{A}{2}\tan\frac{B}{2}\tan\frac{C}{2}\tan\frac{D}{2}=1$

Then:

(a) Both $S_1$ and $S_2$ are true

(b) $S_1$ is not true and $S_2$ is true

(c) $S_1$ is true but $S_2$ is not true

(d) Neither $S_1$ nor $S_2$ is true

38. If cosx = tany, cosy = tanz, cosz = tanx, then sinx = siny = sinz = $2\sin\theta$ where $\theta$ is:

(a) 15° (b) 18°

(c) $22\frac{1}{2}^{o}$ (d) 75°

39. The maximum value of the expression $\left|\sqrt{\sin^2 x + 2a^2} - \sqrt{2a^2 - 1 - \cos^2 x}\right|$, where a and x are real numbers, is

(a) $\sqrt{3}$ (b) $\sqrt{2}$

(c) 1 (d) $\sqrt{5}$

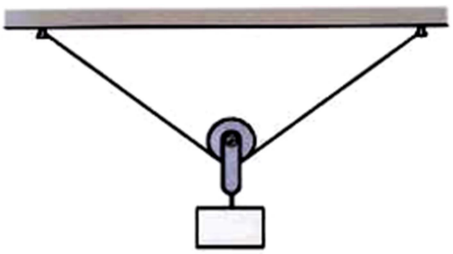
40. Consider an equation (x – a) (x – b) (x – c) + (x – 1) $(x^2 + x + 1) = 0$ whose roots are $\alpha$, $\beta$, $\gamma$. The roots of equation $2(x-\alpha)(x-\beta)(x-\gamma) + 1 - x^3 = 0$ are:

(a) a, b, c (b) $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$

(c) –a, –b, –c (d) $-\frac{1}{a}, -\frac{1}{b}, -\frac{1}{c}$

## [ PHYSICS ]

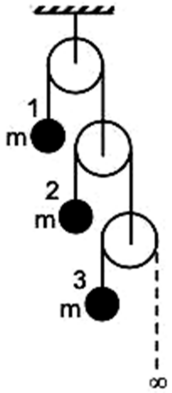
41. A light and inextensible string of length $l$ = 20 m tied between two nails, supports a frictionless pulley of weight $W_p = 10\sqrt{2}$ N from which a block of weight $W_b = 10\sqrt{2}$ N is also suspended as shown in the figure. The nails are fixed in a level a distance x = $10\sqrt{2}$ m apart. Radius of the pulley is r = 10 cm. How much normal reaction per unit of its length does the string apply on the pulley?



(a) 100 N/m (b) $100\sqrt{2}$ N/m

(c) 200 N/m (d) $150\sqrt{3}$ N/m

42. An Atwood's machine having infinite number of masses connected with ideal strings as shown in the figure. All the masses are identical and equal to m. All the pulleys are ideal. Then acceleration of mass-1 is:




(a) g/5 (b) g/2

(c) g/4 (d) g/3

43. DRDO is reportedly developing a "super gun" with a barrel some 70 meters long, which is to be able to launch huge artillery shells several hundred miles. During World War I, Germany used a "Big Bertha" cannon to hurl shells into Paris 30 miles

away. This gun also had a long barrel. What is the reason for using a long barrel in these super guns?

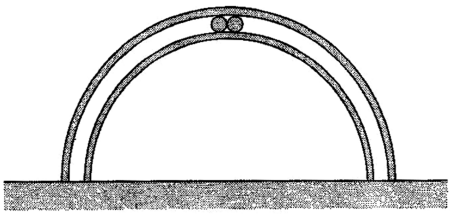
(a) To allow better cooling of the gun due to increased surface area

(b) To provide a more favourable ratio of kinetic energy to potential energy

(c) To allow the force of the expanding gases to act for a longer distance

(d) To increase the force exerted on the bullet due to the expanding gases

44. A semiconductor cylindrical tube is placed on the horizontal ground. Two identical balls that loosely fit inside the tube are simultaneously released from the top inside the tube. Each ball moves down the tube on either side.



Which of the following statements best describe or describes the total normal reaction by the ground on the tube?

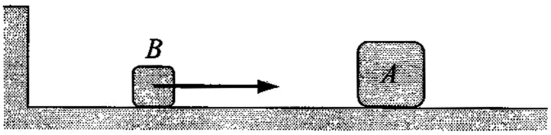
(a) It decreases continually

(b) It increases continually

(c) It first decreases, acquires a minimum value then increases

(d) The tube does not leave the ground

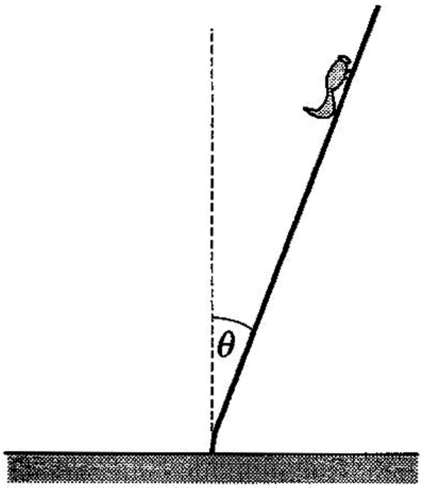
45. A block A is kept at rest on a frictionless horizontal floor some distance away from a wall. Another block B of mass m is moving towards the block A as shown in the figure. The block B may undergo elastic collisions with the block A and the wall. If the two blocks collides only once, what should be range of values of mass M of block A?




(a) $m \leq M \leq 3m$ (b) $0.5\,m \leq M \leq 3m$

(c) $M \leq 3m$ (d) $M = 3m$ only

46. A squirrel of mass m climbs slowly on a thin straight vertical rod of length L. Mass of the rod is negligible as compared to that of the squirrel and size of the squirrel is negligible as compared to the length $l$ it climbs on the rod. Due to weight of the squirrel, the rod bends at its lower end through an angle $\theta$ and a due to elasticity of the material of the rod a restoring torque $C\theta$ is developed in the rod. If $C = 2\,mgL$, find the maximum length, the squirrel can climb on the rod.



(a) L/2

(b) 3L/4

(c) L

(d) Insufficient information

47. There are three persons A, B and C moving with constant velocity. Speed of A is 10 m/sec towards east, velocity of B relative to A is 6 m/sec at an angle of $\cos^{-1}\left(\frac{15}{24}\right)$ north of east. The velocity of C relative to B is 12 m/sec towards west. What will be the magnitude of velocity of C in m/sec?

(a) 2 m/s (b) 6 m/s

(c) 5 m/s (d) 7 m/s

48. A car moves uniformly along a horizontal sine curve y = a sin $\left(\frac{x}{\alpha}\right)$. Where 'a' and '$\alpha$' are constant. The coefficient of friction between wheels and road is $\mu$. At what velocity will the car ride without slipping.

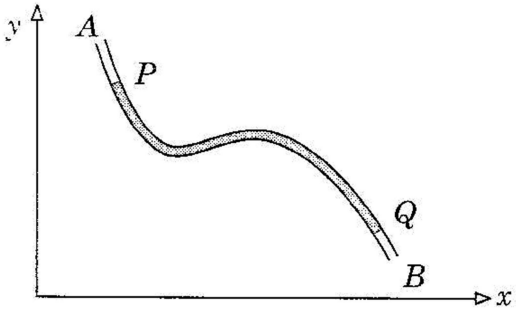
(a) $v_{max} = \alpha\sqrt{\frac{\mu g}{a}}$

(b) $v_{max} = \frac{\alpha\mu g}{a}$

(c) $v_{max} = \alpha^2\sqrt{\frac{\mu g}{a}}$

(d) None of these

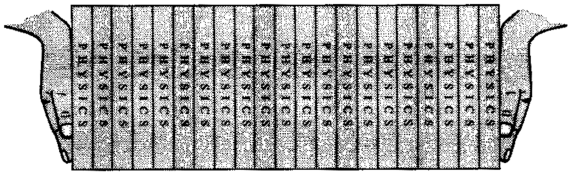
49. A uniform rope PQ of mass m and length $l$ rests inside a fixed pipe PQ. The entire length of the pipe is in a vertical plane as shown. The ends P and Q of the rope are at points $(x_1, y_1)$ and $(x_2, y_2)$. Find expression for total frictional force on the rope.




(a) $\frac{mg(y_1 - y_2)}{l}$ (b) $\frac{mg(y_1 + y_2)}{l}$

(c) $\frac{2mg(y_1 + y_2)}{l}$ (d) $\frac{mg(y_2 - y_1)}{l}$

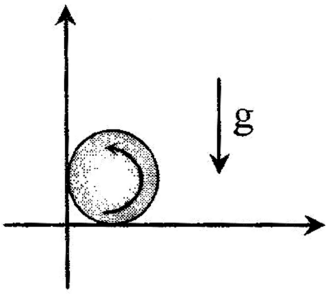
50. A boy lifts a stack of several identical books by pressing hard with his hands. Static friction coefficient between hand and book is $\mu_{hb} = 0.40$, and between each book is $\mu_{bb} = 0.25$ and mass of one book is m = 400 gram. Now the boy starts decreasing the pressure gradually. When the force pressing the book i.e. the horizontal component of the force applied by him becomes F = 120 N, the books are just about to fall down. Acceleration of free fall is g = 10 $m/s^2$. How many books were in the stack?




(a) 15 (b) 17

(c) 18 (d) 19

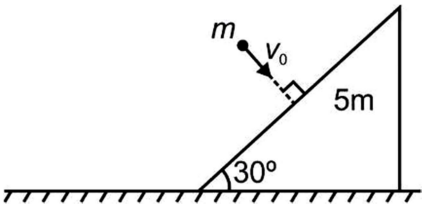
51. A uniform cylinder of radius R (= 3 m) is spinning about its axis at an angular velocity $\omega_0 (= 40\sqrt{\pi}\ \text{rad/sec})$ and placed between two perpendicular wall. The coefficient of friction between the walls and cylinder is $\mu$ (= 2). Then, 25K turns will the cylinder make before its stops. Find the value of K.




(a) 1 (b) 3

(c) 2 (d) 4

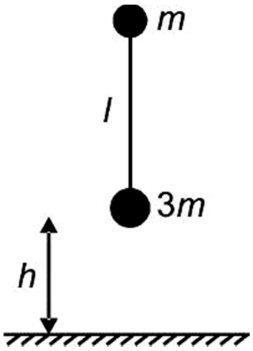
52. A particle of mass m strikes normally to a stationary wedge of mass 5 m kept on the smooth horizontal surface as shown. If the particle sticks to the wedge then loss in kinetic energy of the system during collision is:




(a) $\frac{13}{72}mv_0^2$ (b) $\frac{1}{4}mv_0^2$

(c) $\frac{23}{48}mv_0^2$ (d) $\frac{15}{36}mv_0^2$

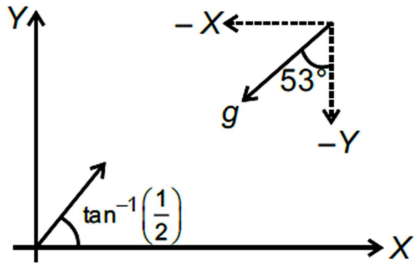
53. A small ball of mass m is connected by an inextensible massless string of length *l* with another ball of mass 3m. They are released from a sufficiently large height h. Time when the string becomes taut for the first time after 3 m strikes the ground is, (all collisions are elastic)




(a) $\frac{l}{\sqrt{gh}}$ (b) $\frac{l}{\sqrt{2gh}}$

(c) $\frac{2l}{\sqrt{gh}}$ (d) $\frac{l}{2\sqrt{2gh}}$

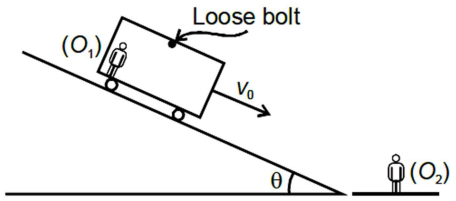
54. A particle is projected obliquely with speed $12\sqrt{5}$ m/s at an angle $\tan^{-1}\left(\frac{1}{2}\right)$ with x axis in a vertical X-Y plane in a region of space where acceleration due to gravity makes an angle 53° with the negative y-axis as shown in figure. The maximum possible X-coordinate of the particle till the time it crosses the x axis is p metre. Find the value of p. ($g = 10\ m/s^2$)



(a) 23 (b) 33

(c) 36 (d) 26

55. A cart is sliding on a smooth incline. An observer $(O_1)$ is fixed to cart and another observer fixed on ground $(O_2)$ observe, a loose bolt that is released from ceiling. At the instant of release cart has velocity $v_0$ as seen by $O_2$. Mark the correct option.




(a) Trajectory of bolt for $O_1$ is parabola

(b) Trajectory of bolt for $O_2$ is straight line inclined at an angle θ with vertical

(c) Trajectory of bolt for $O_2$ is a straight line perpendicular to ceiling of cart

(d) Trajectory of bolt for $O_1$ is straight line

56. On a rainy day, a rain drop falls from very high clouds and faces retardation due to air. This retardation is directly proportional to the instantaneous speed of the drop. An expression for the distance travelled by the drop in time t is

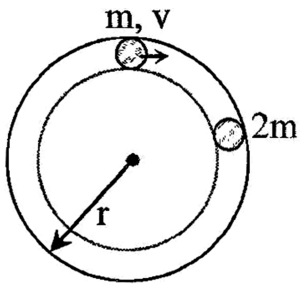
(a) $s = \frac{g}{\alpha^2}(e^{-\alpha t} - 1) + \frac{g}{\alpha}t$

(b) $s = \frac{gt}{\alpha}$

(c) $s = \frac{g}{\alpha^2}(e^{-\alpha t} - 1)$

(d) $s = \frac{gt}{\alpha^2} + \frac{g}{\alpha}(e^{-\alpha t} - 1)$

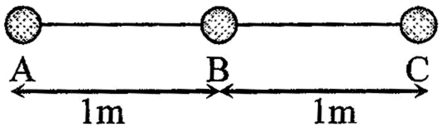
57. A particle of mass 'm' moving with a speed 'v' hits elastically another stationary particle of mass 2m on a smooth horizontal circular tube of radius 'r'. The time in which the next collision will take place is equal to $\left(\frac{x2\pi r}{v}\right)$. Find the value of 'x'.




(a) 3 (b) 1

(c) 2 (d) 5

58. Three identical balls A, B and C each of mass m = 3 kg are connected by string AB and BC as shown in the figure. The whole system is placed on a smooth horizontal surface.

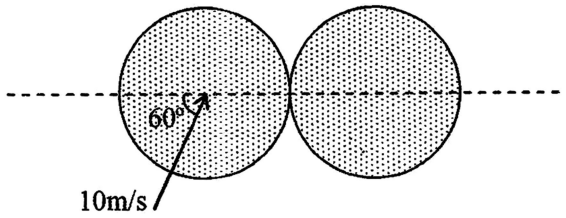



Now the ball B is given an initial velocity $v_0 = \sqrt{3}$ m/s, perpendicular to the string and along the horizontal surface. Find the tension (in Newton) in the string just before the balls A and C collide.

(a) 1 (b) 3

(c) 4 (d) 2

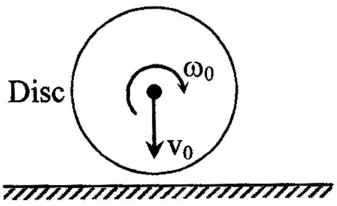
59. A ball of mass 1 kg moving the speed of 10 m/s on a smooth horizontal plane collides obliquely with another ball of same mass at rest as shown in the figure. Coefficient of restitution for the collision is 0.5. If the speed of the striking ball after the collision is $\frac{35}{x}$ m/s, then x is:




(a) 2 (b) 3

(c) 4 (d) 6

60. The figure shown is just before collision, the velocity of centre of uniform disc is $v_0$ vertically downward and $\omega_0$ is the angular velocity as shown. If is found that collision is elastic and after collision disc stops rotating then if coefficient of friction is $\left(\frac{1}{P}\right)$ then the value of P is? If $v_0 = R\omega_0$. (R is radius of disc)




(a) 2 (b) 4

(c) 5 (d) 3

SPACE FOR ROUGH WORK