BEST 2024

TIME : 80 Min. **BOOKLET : A**

BOTHRA ENTRANCE AND SCHOLARSHIP TEST

Class XI Studying Moving to Class XII

Physics, Chemistry & Mathematics

INSTRUCTIONS FOR CANDIDATE

1. The Answer Sheet is provided to you separately which is a machine readable Optical Mark Recognition (OMR). You have to mark your answers in the **OMR** by darkening bubble, as per your answer choice, by using black & blue ball point pen.
2. Total Questions to be Attempted 36. (Mathematics-12), (Physics-12), (Chemistry-12)
3. 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).
4. Think wisely before darkening bubble as there is negative marking for wrong answer.
5. If you are found involved in cheating or disturbing others then your OMR will be cancelled.
6. Do not put any stain on **OMR** and hand it over back properly to the invigilator.

Bothra CLASSES

MATHEMATICS
(Single correct option +4, -1)

1. If in the expansion of $\left(x^3 - \frac{1}{x^2}\right)^n, n \in N$, sum of the coefficients of x^5 and x^{10} is zero, then $n =$
   (a.) 5 (b.)10 (c.)15 (d.)20
2. The value of $\frac{18^3+7^3+3\cdot18\cdot7\cdot25}{3^6+6\cdot243\cdot2+15\cdot181\cdot4+20\cdot27\cdot8+15\cdot9\cdot16+6\cdot3\cdot32+64}$, is
   (a.) 10 (b.) 1 (c.) 2 (d.) 20
3. If the coefficients of x^2 and x^3 in the expansion of $(3 + ax)^9$ are the same, then the value of a, is
   (a.) $-\frac{7}{9}$ (b.) $-\frac{9}{7}$ (c.) $\frac{7}{9}$ (d.) $\frac{9}{7}$
4. Two students while solving a quadratic equation in x, one copied the constant term incorrectly and got the roots 3 and 2. The other copied the constant term coefficient of x^2 correctly as -6 and 1 respectively the correct roots are
   (a.) 3, –2 (b.) –3, 2 (c.) –6, –1 (d.) 6, –1
5. If α, β are the roots of the equation $x^2 + \sqrt{\alpha}\, x + \beta = 0$, then the values of α and β are
   (a)$\alpha = 1, \beta = -1$ (b)α=1,β=−2 (c)α=2,β=1 (d) $\alpha = 2, \beta = -2$
6. The number of real roots of the equation $|x|^2 - 3|x| + 2 = 0$ is
   (a)4 (b)3 (c)2 (d)1
7. On the set of human beings a relation R is defined as follows: "aRb iff a and b have the same brother". Then R is
   (a)Only reflexive (b)Only symmetric (c)Only transitive (d)Equivalence
8. A and B are any two non-empty sets and A is proper subset of B. If $n(A) = 5$, then find the minimum possible value of $n(A \Delta B)$
   (a) Is 1 (b) Is 5
   (c)Cannot be determined (d) None of these
9. Let L be the set of all straight lines in the Euclidean plane. Two lines l_1 and l_2 are said to be related by the relation R iff l_1 is parallel to l_2. Then, the relation R is not
   (a)Reflexive (b)Symmetric (c)Transitive (d)None of these
10. If $\sec\theta \tan\theta = \sqrt{2}$, then $\theta =$
    (a)$n\pi + (-1)^n \frac{\pi}{4}, n \in Z$ (b) $2n\pi \pm \frac{\pi}{3}, n \in Z$ (c)
    (d) $n\pi \pm \frac{2\pi}{3}, n \in Z$ (d) $n\pi - \frac{\pi}{4}, n \in Z$

11. If $\cos(\theta+\phi) = m\cos(\theta-\phi)$, then $\tan\theta$ is equal to

(a) $\frac{1+m}{1-m}\tan\phi$ (b) $\frac{1-m}{1+m}\tan\phi$ (c) $\frac{1-m}{1+m}\cot\phi$ (d) $\frac{1+m}{1-m}\sec\phi$

12. If $\sin(\pi\cos\theta) = \cos(\pi\sin\theta)$, then which of the following is correct?

(a) $\cos\theta = \frac{3}{2\sqrt{2}}$ (b) $\cos\left(\theta-\frac{\pi}{2}\right) = \frac{1}{2\sqrt{2}}$

(c) $\cos\left(\theta-\frac{\pi}{4}\right) = \frac{1}{2\sqrt{2}}$ (d) $\cos\left(\theta+\frac{\pi}{4}\right) = \frac{1}{2\sqrt{2}}$

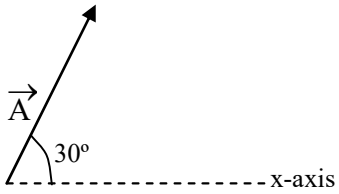
PHYISCS

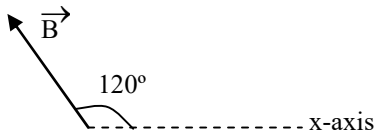
(Single correct option +4, -1)

1. If force F, acceleration A and time T are basic physical quantities, the dimensions of energy are –

(a) $[F^2A^{-1}T]$ (b) $[FAT^2]$ (c) $[FAT^{-2}]$ (d) $[FA^{-1}T]$

2. Vector $\vec{A}$ and $\vec{B}$ are shown in the figure. The angle between vector $\vec{A}$ and $\vec{B}$ is –





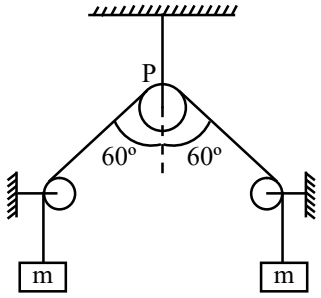
(a) 60° (b) 90° (c) 30 ° (d) none of these

3. A ball is projected with velocity u at an angle α with horizontal plane. Its speed when it makes an angle β with the horizontal is -

(a) u cos α (b) $\frac{u}{\cos\beta}$

(c) u cos α cos β (d) $\frac{u\cos\alpha}{\cos\beta}$

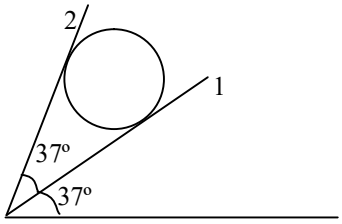
4. The force exerted by the string on pulley P is –



(a) mg (b) 2 mg

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

5. A sphere of mass m is held between two smooth inclined walls. For sin 37° = 3/5, the normal reaction of the wall (2) is equal to -

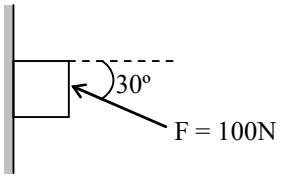


(a) mg (b) mg sin 74° (c) mg cos 74° (d) None of these

6. A particle moves on a rough horizontal ground with some initial velocity say v_0. If $3/4^{th}$ of its kinetic energy is lost in friction in time t_0. Then coefficient of friction between the particle and the ground is -

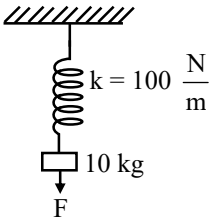
(a) $\frac{v_0}{2gt_0}$ (b) $\frac{v_0}{4gt_0}$ (c) $\frac{3v_0}{4gt_0}$ (d) $\frac{v_0}{gt_0}$

7. A force of 100 N is applied on a block of mass 3 kg as shown in figure. The coefficient of friction between the surface and block is 1/4. The friction force acting on the block is –



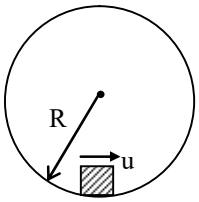
(a) 15 N downwards (b) 25 N upwards
(c) 20 N downwards (d) 20 N upwards

8. A vertical spring of force constant 100 N/m is attached with a hanging mass of 10 kg. Now an external force is applied on the mass so that the spring is stretched by additional 2 m. The work done by the force F is : ($g = 10\ m/s^2$)



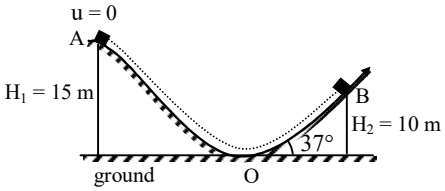
(a) 200 J (b) 400 J (c) 450 J (d)600 J

9. A particle is given an initial speed u inside a smooth spherical shell of radius R = 1 m that it is just able to complete the circle. Acceleration of the particle when its velocity is vertical is -



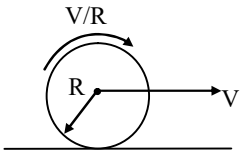
(a) g $\sqrt{10}$ (b) g (c) g $\sqrt{2}$ (d) 3g

10. A body starts slipping on a smooth track from point A and leaves the track from point B as shown. The part OB of track is straight at angle 37° with horizontal. Then the maximum height of body from ground when it is in air is ($g = 10\ m/s^2$)



(a) 16.8 m (b) 13.6 m (c) 11.8 m (d) None of these

11. A disc is performing pure rolling on a smooth stationary surface with constant angular velocity as shown in figure. At any instant, for the lower most point of the disc.



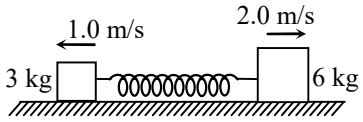
(a) Velocity is v, acceleration is zero

(b) Velocity is zero, acceleration is zero

(c) Velocity is v, acceleration is $\frac{v^2}{R}$

(d) Velocity is zero, acceleration is nonzero

12. Two blocks of mass 3 kg and 6 kg respectively are placed on a smooth horizontal surface. They are connected by a light spring of force constant k = 200 N/m. Initially the spring is unstretched. The indicated velocities are imparted to the blocks. The maximum extension of the spring will be –



(a) 30 cm (b) 25 cm (c) 20 cm (d) 15 cm

CHEMISTRY

(Single correct option +4, -1)

1. Number of atoms in the following samples of substances is the largest in :
   (a) 127.0g of iodine (b) 48.0g of magnesium
   (c) 71.0g of chlorine (d) 4.0g of hydrogen
2. The concentrated sulphuric acid that is peddled commercially is 95% H_2SO_4 by weight. If the density of this commercial acid is 1.834 g cm^{-3}, the molarity of this solution is :-
   (a) 17.8 M (b) 15.7 M (c) 10.5 M (d) 12.0 M
3. The ratio of masses of oxygen and nitrogen in a particular gaseous mixture is 1 : 4. The ratio of number of their molecule is :
   (a) 1 : 8 (b) 3 : 16 (c) 1 : 4 (d) 7 : 32
4. If the kinetic energy of an electron is increased four times, the wavelength of the de-Broglie wave associated with it would become
   (a) Two times (b) Half (c) One fourth (d) Four times
5. Ionisation energy of He^+ is 19.6×10^{-18}J $atom^{-1}$. The energy of the first stationary state (n = 1) of Li^{2+} is
   (a)8.82×10^{-17} J $atom^{-1}$ (b) 4.41×10^{-16} J $atom^{-1}$
   (c) -4.41×10^{-17} J $atom^{-1}$ (d) -2.2×10^{-15} J $atom^{-1}$
6. In the Bohr series of lines of hydrogen spectrum, the third line from the red end corresponds to which one of the following inter-orbit jumps of the electron for Bohr orbits in an atom of hydrogen
   (a) 5 → 2 (b) 4 → 1 (c) 2→ 5 (d) 3→ 2
7. The increasing order of the ionic radii of the given isoelectronic species is?
   (a) K^+, S^{2-}, Ca^{2+}, Cl^- (b) Cl^-, Ca^{2+}, K^+,S^{2-}
   (c) S^{2-}, Cl^-, Ca^{2+}, K^+ (d) Ca^{2+}, K^+, Cl^-, S^{2-}
8. Which is the correct order of second ionization potential of C, N, O and F in the following?
   (a) O > F > N > C (b) O > N > F > C (c) C > N > O > F (d) F > O > N > C
9. According to the Periodic Law of elements, the variation in properties of elements is related to their.
   (a) nuclear masses (b) atomic numbers
   (c) nuclear neutron-proton number ratios (d) atomic masses
10. Using MO theory, predict which of the following species has the shortest bond length?
    (a) O_2^- (b) O_2^{2-} (c) O_2^{2+} (d) O_2^+
11. The hybridisation of orbitals of N atom in NO_3^-, NO_2^+, NH_4^+ are respectively:
    (a) sp^2, sp^3, sp (b) sp, sp^3, sp^2 (c) sp, sp^2, sp^3 (d) sp^2, sp, sp^3
12. In which of the following pairs the two species are not isostructural?
    (a) AlF_6^{3-} and SF_6 (b) CO_3^{2-} and NO_3^- (c) PCl_4^+ and $SiCl_4$ (d) PF_5 and BrF_5