FIITJEE COMMON TEST – 3

PHYSICS, CHEMISTRY & MATHEMATICS

**Forthcoming Exam –
Big Bang Edge Test
on 20th Oct. 2019**

CODE:

Time Allotted: 3 Hours   **Maximum Marks: 186**

- Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.
- You are not allowed to leave the Examination Hall before the end of the test.

INSTRUCTIONS

Caution: Question Paper CODE as given above MUST be correctly marked in the answer OMR sheet before attempting the paper. Wrong CODE or no CODE will give wrong results.

A. General Instructions

1. Attempt ALL the questions. Answers have to be marked on the OMR sheets.
2. This question paper contains Three Section.
3. **Section-I** is Physics, **Section-II** is Chemistry and **Section-III** is Mathematics.
4. Each section is further divided into two parts: **Part-A & Part-C**
5. Rough spaces are provided for rough work inside the question paper. No additional sheets will be provided for rough work.
6. Blank Papers, clip boards, log tables, slide rule, calculator, cellular phones, pagers and electronic devices, in any form, are not allowed.

B. Filling of OMR Sheet

1. Ensure matching of OMR sheet with the Question paper before you start marking your answers on OMR sheet.
2. On the OMR sheet, darken the appropriate bubble with HB pencil for each character of your Enrolment No. and write in ink your Name, Test Centre and other details at the designated places.
3. OMR sheet contains alphabets, numerals & special characters for marking answers.

C. Marking Scheme For All Three Parts.

(i) **Part-A (01 – 05)** contains 5 multiple choice questions which have only one correct answer. Each question carries **+3 marks** for correct answer and **– 1 mark** for wrong answer.

    PART – A (**06 – 13**) contains 8 Multiple Choice Questions which have **One or More Correct** answer.
For each question in the group **Q. 6 – 13** of **PART – A** you will be awarded
Full Marks: **+4** If only the bubble(s) corresponding to all the correct options(s) is (are) darkened.
Partial Marks: **+1** For darkening a bubble corresponding **to each correct option,** provided NO incorrect option is darkened.
Zero Marks: **0** If none of the bubbles is darkened.
Negative Marks: **–1** In all other cases.
For example, if **(A), (C) and (D)** are all the correct options for a question, darkening all these three will result in **+4 marks**; darkening only **(A) and (D)** will result in **+2 marks**; and darkening **(A) and (B)** will result in **–1** marks, as a wrong option is also darkened.

(iii) **Part-C (01 – 05)** contains 5 Numerical based questions with single digit integer as answer, ranging from 0 to 9 and each question carries **+3 marks** for correct answer. There is no negative marking.

Name of the Candidate : _____

Batch : _____ **Date of Examination :** _____

Enrolment Number : _____

PART – I: PHYSICS
SECTION – A
(Single Correct Choice Type)

This section contains **5 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.**
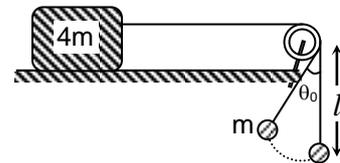
1. Initially the spring is stretched by x_1 from its original length. If the work done is W, find out the additional work done to stretch it further by $(3x_1)$ distance towards right
    (A) 3W (B) 9 W
    (C) 8 W (D) can't be found
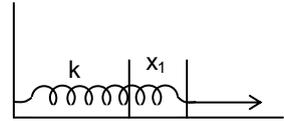
2. The work done by tension in lowering down a block of mass = m kg through a distance 'd' is
    (A) $mg\dfrac{d}{4}$ (B) $3mg\dfrac{d}{4}$
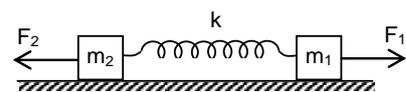   (C) $-3mg\dfrac{d}{4}$ (D) mgd
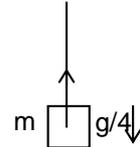
3. Two bodies of masses *m* and 4 *m* are attached with string as shown in the figure. The body of mass *m* hanging from a string of length *l* is executing oscillations of angular amplitude θ_0, while the other body is at rest. The minimum coefficient of friction between the mass 4 *m* and the horizontal surface should be
    (A) $\left(\dfrac{2-\cos\theta_0}{3}\right)$ (B) $2\cos^2\left(\dfrac{\theta_0}{2}\right)$ (C) $\left(\dfrac{1-\cos\theta_0}{2}\right)$ (D) $\left(\dfrac{3-2\cos\theta_0}{4}\right)$

4. A force F = -k(yi + xj) acts on a particle moving in xy plane. Starting from the origin, the particle is taken along the positive x axis to the point (a, 0) and than parallel to the y-axis to the point (a, a). the total work done by the force F on the particle is
    (A) $-2ka^2$ (B) $2ka^2$ (C) $-ka^2$ (D) ka^2

5. Two blocks of masses m_1 and m_2 are connected with a spring of string constant k. They are kept on a smooth horizontal surface as shown in figure. Initially, the blocks are at rest and the spring is unstretched. If the blocks are pulled by forces F_1 and F_2 as shown in figure, then maximum extension in the spring will be
   (A) $\dfrac{F_1 m_1 + F_2 m_2}{K(m+m_2)}$ (B) $\dfrac{F_1 m_2 + F_2 m}{K(m+m_2)}$ (C) $2\dfrac{F_1 m_2 + F_2 m_1}{K(m_1 + m_2)}$ (D) $\dfrac{F_1 m_1 + F_2 m_2}{2K(m_1 + m_2)}$

Space for rough work

(Multi Correct Choice Type)

This section contains **8 multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

6. In the adjoining figure block *A* is of mass *m* and block *B* is of mass 2m. The spring has a force constant *k*. All the surfaces are smooth and the system is released from rest with spring unstretched
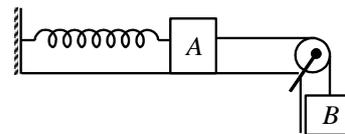
    (A) The maximum extension of the spring is $\dfrac{4mg}{k}$

    (B) The speed of block *A* when extension in spring is $\dfrac{2mg}{k}$, is $2g\sqrt{\dfrac{2m}{3k}}$

    (C) Net acceleration of block *B* when the extension in the spring is maximum, is $\dfrac{2}{3}g$.

    (D) Tension in the thread for extension of $\dfrac{2mg}{k}$ in spring is *mg*.

7. A particle of mass 5 *kg* moving in the *X-Y* plane has its potential energy given by $U = (-7x + 24y)$
    Joule. The particle is initially at origin and has velocity $\vec{u} = (14.4\hat{i} + 4.2\hat{j})$ *m/s*
    (A) the particle has speed 25 *m/s* at $t = 4 \sec$
    (B) the particle has an acceleration $5 \ m/s^2$
    (C) the acceleration of particle is normal to its initial velocity
    (D) none of these

8. The coefficient of friction between the block and plank is μ and its value is such that block becomes stationary with respect to plank before it reaches the other end. Then
    (A) the work done by friction on the block is negative
    (B) the work done by friction on the plank is positive
    (C) the net work done by friction is negative
    (D) net work done by the friction is zero
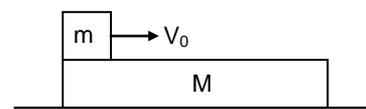
9. A particle initially at rest moves in a straight line with constant acceleration under a constant force F. Select the correct alternative(s). (More than one option may be correct)
    (A) power developed by this force varies linearly with time
    (B) power developed by this force varies parabolically with time
    (C) power developed by this force varies linearly with displacement
    (D) power developed by this force varies parabolically with displacement

Space for rough work

10. In the shown arrangement the blocks are released from rest and allowed to move through a distance of h. There is no friction and the string is light. Then
    (A) total mechanical energy of the system is not conserved since besides gravity tension also does work on each of the blocks.
    (B) work done by tension on each block is separately zero.

    (C) work done by tension on block A is positive and on block B it is negative.
    (D) total mechanical energy is conserved.
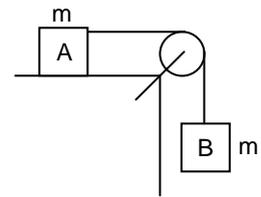
11. Figure shows a massless spring fixed at the bottom end of an inclined of inclination 37^0 (tan 37^0 = 3/4). A small block of mass 2 kg start slipping down the incline from a point 4.8 m away from free end of spring. The block compresses the spring by 20 cm, stops momentarily and then rebounds through a distance 1 m up the inclined, then (g = 10 m/s^2)

    (A) coefficient of friction between block and inclined is 0.5.

    (B) coefficient of friction between block and inclined is 0.75.

    (C) value of spring constant is 1000 N/m.

    (D) value of spring constant is 2000 N/m.
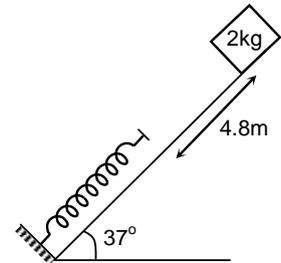
12. Kinetic energy of a particle moving in a straight line is proportional to the time t. The magnitude of the force acting on the particle is
    (A) directly proportional to the speed of the particle
    (B) inversely proportional to $\sqrt{t}$
    (C) inversely proportional to the speed of the particle
    (D) directly proportional to $\sqrt{t}$

13. A block is suspended by an ideal spring of force constant k. If the block is pulled down by applying a constant force F and if maximum displacement of block from its initial position of rest x_0 then (More than one option may be correct)
    (A) work done by spring is $-\dfrac{1}{2}kx_o^2$ (B) $x_0 = \dfrac{3F}{2k}$

    (C) $x_0 = \dfrac{2F}{K}$ (D) work done by applied force F is Fx_0

SECTION – C
(Integer Type)
This section contains **5 questions**. The answer to each question is a **single-digit integer**, ranging from 0 to 9. The correct digit below the question number in the ORS is to be bubbled.

1. A particle of mass m is moving in a circular path of constant radius r(1m) such that it's centripetal acceleration a_c is varying with time t as $a_c = k^2rt^2$, where k is a constant, then power delivered to the particle by the forces acting on it at t = 5 sec. (take $mk^2 = 1\,unit$)

Space for rough work

2. Two identical beads of *m* = 100 gram are connected by an inextensible massless string can slide along the two arms *AC* and *BC* of a rigid smooth wire frame in a vertical plane. If the system is released from rest, the kinetic energy of the first particle when they have moved by a distance of 0.1 m is $8x \times 10^{-3}$ J. Find the value of *x*. (g = 10 m/s²)
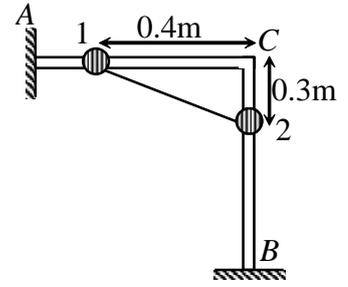
3. An object is displaced from point A(1m, 2m, 3m) to a point B(2m, 3m, 4m) under a constant force $\vec{F} = \left(2\hat{i} + 3\hat{j} + 4\hat{k}\right)N$. Find the work done by this force in this process. (in joule)

4. A system consists of two identical slabs each of mass m linked by compressed weightless spring of stiffness k as shown in Figure. The slabs are also connected by a thread, which is burnt at a certain moment. If the value of $\Delta \ell$ the initial compression of spring, the lower slab will bounce up after the thread is burned through is $\dfrac{x\,mg}{k}$, then find the value of 'x'.
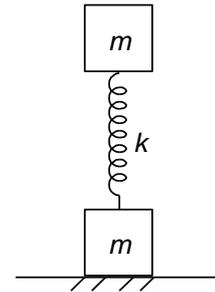

5. A locomotive of mass m starts moving so that its speed varies according to the law $v = a\sqrt{S}$ where a is a constant and S is the distance covered. If the total work performed by all the forces, which are acting on the locomotive during the first t seconds after the beginning of motion is $\dfrac{ma^2t^2}{x}$, then find the value 'x'.

Space for rough work

PART – II: CHEMISTRY

SECTION – A

(Single Correct Choice Type)

This section contains **5 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.**

1. Which of the following compound(s) gives CO_2 on heating?
   (A) $Na_2CO_3.10H_2O$ (B) $NaHCO_3$ (C) $Na_2CO_3.7H_2O$ (D) $Na_2CO_3.H_2O$

2. Which of the following two substances have identical value of magnetic moment?
   (A) $FeSO_4$ and $NiSO_4$ (B) $V(NO_3)_2$ and $Co(NO_3)_2$
   (C) $CuCl_2$ and $ZnCl_2$ (D) MnO and CoO

3. Which of the following compound is formed by heating hard water?
   (A) $MgCl_2$ (B) $CaCO_3$ (C) $Ca(HCO_3)_2$ (D) $MgSO_4$

4. Which of the following molecule has angular shape?
   (A) $BeCl_2$ (B) XeF_2 (C) SF_2 (D) CO_2

5.
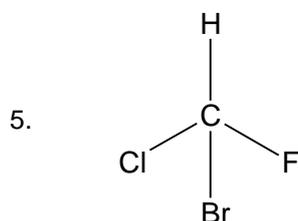
   Which covalent bond in the above molecule contains the least amount of s-orbital character of the central atom?
   (A) C – H   (B) C – Cl   (C) C – F   (D) C – Br

(Multi Correct Choice Type)

This section contains **8 multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

6. In which of the following atoms, same number of electrons (maximum for the atom) have $+\frac{1}{2}$ spin quantum number?
   (A) Cr(Z = 24)   (B) Mn(Z = 25)   (C) Fe(Z = 26)   (D) Co(Z = 27)

7. Which of the following statement(s) is/are correct for oxygen atom?
   (A) It provides the highest positive oxidation state to element with which it combines except fluorine.
   (B) It follows Hund's rule
   (C) The orbital angular momentum of its valence electrons may be zero and positive
   (D) One of the wave functions of its valence shell orbital is $\Psi_{2, 1, 0}$

Space for rough work

8.   Which of the following statement(s) is/are correct for the molecules $COCl_2$ and $SOCl_2$?
        (A) Central atoms of both molecules undergo same type of hybridization.
        (B) Bond angle $\angle ClCCl$ is greater than that of $\angle ClSCl$
        (C) The number of electron pair interactions is more in $SOCl_2$ than in $COCl_2$
        (D) d-orbitals participate in hybridization in $SOCl_2$ whereas $COCl_2$ involves no d-orbitals for hybridization.

9.   Which of the following molecule(s) has/have larger bond angle than CF_4?
        (A) BF_3 (B) NF_3 (C) BeF_2 (D) OF_2

10.   Which of the following substance(s) on heating form(s) the corresponding metal oxide?
        (A) LiOH   (B) $MgCO_3$ (C) $Ca(NO_3)_2$ (D) Na_2CO_3

11.   Which of the following property(ies) is/are common among the given compounds?
            Li_2O, Na_2O_2, KO_2
        (A) Formation of hydroxide ion in water   (B) Formation of H_2O_2 when reacts with water
        (C) Evolution of gas upon treatment with water   (D) Presence of paramagnetic anion

12.   In which of the following compound the central atom uses maximum number of hybridized d-orbitals for bond formation?
        (A) SOF_4 (B) XeO_2F_2 (C) $XeOF_4$ (D) SO_2F_2

13.   Which of the following statement(s) is/are correct for PCl_5?
        (A) In solid state it contains ion pairs like $[PCl_6]^-$ and $[PCl_4]^+$
        (B) Three different bond angles are observed in the molecule
        (C) The bond energy of $[PCl_4]^+$ is higher than that of $[PCl_6]^-$
        (D) Phosphorus uses 3d orbitals for hybridization in PCl_5

SECTION – C
(Integer Type)

This section contains **5 questions**. The answer to each question is a **single-digit integer**, ranging from 0 to 9. The correct digit below the question number in the ORS is to be bubbled.

1.   How many lone pair(s) of electrons is/are present on xenon in XeF_4?

2. BF_3, CO_2, SO_2, OF_2, CH_4, NH_3, SO_3, NO_2 and H_2O
        How many of the above molecule(s) has/have bond order greater than one?

3.   The dipole moment of H_2O is greater than that of CO_2. If the dipole moment of water is 1.8 Debye, what will be the dipole moment of CO_2?

4.   Number of water molecules attached with single molecule through Hydrogen-bonding in liquid state is

5.   Number of unpaired electrons present in KO_2 is

Space for rough work

PART – III: MATHEMATICS
SECTION – A
(Single Correct Choice Type)

This section contains **5 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.**

1. The equation of director circle of the circle $x^2 + y^2 = 1$ is
   (A) $x^2 + y^2 = 2$ (B) $x^2 + y^2 = \sqrt{2}$ (C) $x^2 + y^2 = 4$ (D) none

2. The maximum distance of the point on the circle $x^2 + y^2 - 12x - 4y + 30 = 0$ from the origin is:
   (A) $\sqrt{10}$ (B) $2\sqrt{10}$ (C) $3\sqrt{10}$ (D) none

3. The area of the triangle formed by the tangents from the point (4, 3) to the circle $x^2 + y^2 = 9$ and the chord of contact of (4, 3) is:
   (A) $\dfrac{192}{25}$ (B) 192   (C) 25   (D) 250

4. The number of common tangents to the circles $x^2 + y^2 + 2x + 8y - 23 = 0$ and $x^2 + y^2 - 4x - 10y + 19 = 0$ is:
   (A) 1   (B) 2   (C) 3   (D) 4

5. Radii of two circles are 4 units and 8 units. Their centres are $(-1, -2)$ and $(2, 2)$ respectively. The length of their external common tangent is
   (A) no external common tangent exists   (B) 3 units
   (C) 6 units   (D) none of these

(Multi Correct Choice Type)

This section contains **8 multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

6. Two tangents OA and OB are drawn to the circle $x^2 + y^2 + 4x + 6y + 12 = 0$ from origin O. Then:

   (A) Circumradius of triangle OAB is $\sqrt{13}$ (B) Circumradius of triangle OAB is $\dfrac{1}{2}\sqrt{13}$

   (C) Circumcentre of triangle OAB is $(-2, -3)$ (D) Circumcentre of triangle OAB is $\left(-1, -\dfrac{3}{2}\right)$

7. The equation of the circle which touches both the axes and the line $\dfrac{x}{3} + \dfrac{y}{4} = 1$ and lies in the first quadrant is $(x - c)^2 + (y - c)^2 = c^2$ where c is
   (A) 1   (B) 2   (C) 4   (D) 6

8. Which of the following lines cut off intercepts of equal length on the circle $x^2 + y^2 - 2x + 4y = 0$?
   (A) $3x - y = 0$ (B) $x + 3y = 0$ (C) $x + 3y + 10 = 0$ (D) $3x - y - 10 = 0$

Space for rough work

9. The circles $x^2 + y^2 = 1$ and $x^2 + y^2 = 2x$

    (A) intersect in two distinct points

    (B) intersect on the line $x = \dfrac{1}{2}$

    (C) intersect in the points $\left(\dfrac{1}{2}, \dfrac{\sqrt{3}}{2} \right)$ and $\left(\dfrac{1}{2}, -\dfrac{\sqrt{3}}{2} \right)$

    (D) have 2 common tangents

10. Find the equation of the circle passing through the point of intersection of the circles
    $x^2 + y^2 - 6x + 2y + 4 = 0$, $x^2 + y^2 + 2x - 4y - 6 = 0$ and with its centre on the line $y = x$.
    (A) $7x^2 + 7y^2 - 10x - 10y - 12 = 0$ (B) $x^2 + y^2 - 10x - 10y - 12 = 0$
    (C) $7x^2 + 7y^2 + 10x + 10y - 12 = 0$ (D) $x^2 + y^2 + 10x + 10y + 12 = 0$

11. An equation of a line passing through the point (–2, 11) and touching the circle $x^2 + y^2 = 25$ is
    (A) $4x + 3y = 25$ (B) $3x + 4y = 38$ (C) $24x - 7y + 125 = 0$ (D) $7x + 24y - 230 = 0$

12. The point (2, 3), (0, 2), (4, 5) and (0, t) are concyclic, then the value of t is:
    (A) 2   (B) 1   (C) 17   (D) 19

13. An equation of the tangent to the circle $x^2 + y^2 + 4x - 4y + 4 = 0$ which makes equal intercepts on
    the co – ordinate axes, is given by:
    (A) $x + y = 2\sqrt{2}$ (B) $x - y = 2\sqrt{2}$ (C) $x + y + 2\sqrt{2} = 0$ (D) $x - y + 2\sqrt{2} = 0$

SECTION – C
(Integer Type)
This section contains **5 questions**. The answer to each question is a **single-digit integer**, ranging from 0 to
9. The correct digit below the question number in the ORS is to be bubbled.

1. The lines $12x - 5y - 17 = 0$ and $24x - 10y + 44 = 0$ are tangents to the same circle. The length of
    diameter of this circle is

2. Number of integral values of 'k' for which the two circles $x^2 + y^2 + 2x + 2ky + 6 = 0$ and
    $x^2 + y^2 + 2ky + k = 0$ intersect orthogonally is _____

3. Tangents are drawn to circle $x^2 + y^2 = 12$ at the points where it is met by the line $5x - 3y - 10 = 0$,
    then x – coordinate of points of intersection of these tangents is _

4. The circle $x^2 + y^2 + 4x - 7y + 12 = 0$ cuts on intercept on y – axis equal to k units. Then the value of
    k is _____

5. The angle between the tangents drawn from the point (–1, 3) of the circle $x^2 + y^2 = 5$ is $\dfrac{\pi}{k}$ then k is

Space for rough work