

**FIITJEE COMMON TEST – 3****PHYSICS, CHEMISTRY & MATHEMATICS****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 option(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 :** \_\_\_\_\_

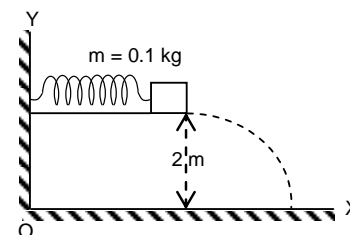
**PART – I: PHYSICS****SECTION – A****(Single Correct Choice Type)**

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. A particle is released from rest at origin. It moves under the influence of potential field  $U = x^2 - 3x$ , where  $U$  is in Joule and  $x$  is in metre. Kinetic energy at  $x = 2\text{m}$  will be  
 (A) 2 J (B) 1 J  
 (C) 1.5 J (D) 0 J

1. **A**

2. A small block of mass  $0.1\text{ kg}$  is pressed against a horizontal spring fixed at one end to compress the spring through  $5.0\text{ cm}$  as shown. The spring constant is  $100\text{ N/m}$ . When released the block moves horizontally till it leaves the spring. It will hit the ground  $2\text{ m}$  below the spring.



- (A) at a horizontal distance of  $1\text{ m}$  from free end of the spring.  
 (B) at a horizontal distance of  $2\text{ m}$  from free end of the spring.

- (C) vertically below the edge on which the mass is resting.  
 (D) at a horizontal distance  $\sqrt{2}\text{ m}$  from free end of spring.

2. **A**

3. A bob is suspended from a crane by a cable of length  $\ell = 5\text{ m}$ . The crane and the bob are moving at a constant speed  $v_0$ . The crane is stopped by a bumper and the bob on the cable swings out an angle of  $60^\circ$ . The initial speed  $v_0$  is ( $g = 9.8\text{ m/s}^2$ )

- (A)  $10\text{ m/s}$  (B)  $7\text{ m/s}$   
 (C)  $4\text{ m/s}$  (D)  $2\text{ m/s}$

3. **B**

4. A block of mass  $m = 0.1\text{ kg}$  is released from a height  $4\text{ m}$  on a curved smooth surface. On the horizontal smooth surface it collides with a spring of force constant  $800\text{ N/m}$ . The maximum compression in spring will be ( $g = 10\text{ m/s}^2$ )



- (A)  $1\text{ cm}$  (B)  $5\text{ cm}$   
 (C)  $10\text{ cm}$  (D)  $20\text{ cm}$

4. **C**

5. The speed  $v$  reached by a car of mass  $m$ , driven with a constant power  $P$ , is given by (where  $x$  is displacement in metre)

- (A)  $v = \frac{3xP}{m}$  (B)  $v = \left(\frac{3xP}{m}\right)^{1/2}$  (C)  $v = \left(\frac{3xP}{m}\right)^{1/3}$  (D)  $v = \left(\frac{3xP}{m}\right)^2$

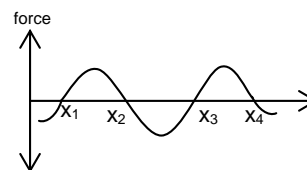
5. **C**

(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. A curve between force and displacement is drawn for a particle moving in x axis only conservative forces are acting

- (A) At  $x_1$  &  $x_3$  particle in stable equilibrium
- (B) At  $x_1$  &  $x_3$  particle in unstable equilibrium
- (C) At  $x_2$  &  $x_4$  particle in stable equilibrium
- (D) At  $x_2$  &  $x_4$  particle in unstable equilibrium



6. **BC**

7. A box of mass 'm' is carried by a man of mass 'M'. If he is moving up the plane with a constant velocity 'V' on an inclined plane of inclination  $\theta$  with horizontal. For the time 't' and with respect to man, choose the incorrect option(s).

- (A) Work done by man on the box be  $mg vt \sin \theta$ .
- (B) Work done by gravity on the box be  $-mg vt \sin \theta$
- (C) Rise in potential energy of earth box system be  $mg vt \sin \theta$
- (D) none of the above

7. **AB**

8. A bullet loses 19% of its kinetic energy when passes through an obstacle. The percentage change in its speed is

- (A) reduced by 10%
- (B) reduced by 19%
- (C) reduced by 9.5%
- (D) reduced by 11%

8. **A**

9. Choose the correct option(s)

- (A) If only conservative forces act on a particle, the kinetic energy stays constant.
- (B) If the net force acting on an object is zero, then the object is at rest.
- (C) If net mechanical work is done on a body, the velocity body must change.
- (D) If net mechanical work is done on a body, the speed of body must change.

9. **CD**

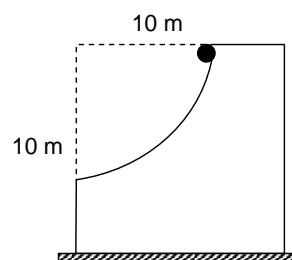
10. An ideal spring with spring-constant k is hung from the ceiling and a block of mass M is attached to its lower end. The mass is released with the spring initially unstretched. Then the maximum extension in the spring is

- (A)  $\frac{4 Mg}{k}$
- (B)  $\frac{2 Mg}{k}$
- (C)  $\frac{Mg}{k}$
- (D)  $\frac{Mg}{2k}$

10. **B**

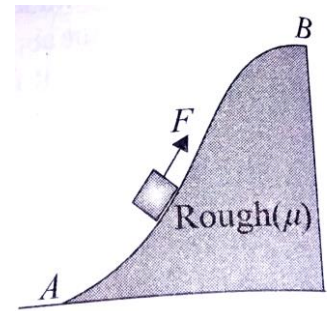
11. A body of mass m slides down a smooth curved track of same mass which is the quadrant of circle having radius 10 m. The speed of the body at the bottom of track is

- (A)  $10\sqrt{2}$  m/s
- (B) 10 m/s
- (C) 2 m/s
- (D) 20 m/s



11. **A**

12. A body of mass  $M$  was slowly hauled up the rough hill by a force  $F$  which at each point was directed along a tangent to the hill. Work done by the force
- (A) is independent of shape of trajectory.  
 (B) depends upon vertical component of displacement but independent of horizontal component.  
 (C) depends upon both the components of displacement.  
 (D) does not depend upon coefficient of friction.



12. **AC**
13. An automobile of mass  $m$  accelerates, starting from rest, while the engine supplies constant power  $P$
- (A) The velocity is given as a function of time by  $v = 2Pt/m^{1/2}$   
 (B) The position is given as a function of time by  $s = 8P/9m^{1/2}t^{3/2}$   
 (C) The velocity is given as a function of time by  $v = Pt/m^{1/2}$   
 (D) The position is given as a function of time by  $s = 4P/9m^{1/2}t^{3/2}$
13. **AB**

**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 uniform chain of length  $\ell$  and mass  $m$  overhangs a smooth table with its two third part lying on the table. If the kinetic energy of the chain as it completely slips off the table is  $\frac{2}{x}mgl$ , then find the value of 'x'.
1. **4.5**
2. A block of mass 1 kg is moved with a speed of 10 m/s at the highest point in a closed circular fixed tube of radius 1m kept in a vertical plane. The cross section of the tube is such that the block just fits in it. The block makes several oscillations inside the tube and finally stops at the lowest point. The work done by the tube on the block during the process is  $-10x$  J. Find the value of x.
2. **7**
3. Potential energy of a particle moving along x-axis is given by  $U = \frac{x^3}{3} - \frac{9x^2}{2} + 20x$ . Find out position of stable equilibrium state.
3. **5**
4. A particle of mass  $m$  is fixed to one end of a light rigid rod of length  $\ell$  and rotated in a vertical circular path about its other end. The minimum speed of particle at its highest point is  $\sqrt{KgL}$ . Find the value of K.
4. **4**

**COMMON TEST # 3 – C-XI-5**

5. A particle hanging by a light string of length  $l$  is projected horizontally from its lowest point with velocity =  $\sqrt{\frac{7gl}{2}}$ , The string slacks after swinging through an angle  $\frac{2\pi}{n}$  then  $n =$

5. **3**

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*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. The incorrect statement among the following is:  
 (A) The first ionisation potential of Al is less than the first ionisation potential of Mg.  
 (B) The second ionisation potential of Mg is greater than the  $IE_2$  of Na.  
 (C) The first ionisation potential of Na is less than the first ionisation potential of Mg.  
 (D) The third ionisation potential of Mg is greater than the third ionisation potential of Al.

1. B

2. Which of the following order of lattice energy values ( $\text{kJ mol}^{-1}$ ) is correct?  
 (A)  $\text{CaO} > \text{SrO} > \text{BaO} > \text{MgO}$  (B)  $\text{MgO} > \text{CaO} > \text{SrO} > \text{BaO}$   
 (C)  $\text{SrO} > \text{CaO} > \text{MgO} > \text{BaO}$  (D)  $\text{MgO} > \text{CaO} > \text{BaO} > \text{SrO}$

2. B

3. Pick out the isoelectronic structures from the following;  
 I.  $\text{CH}_3^-$ , II.  $\text{H}_3\text{O}^+$ , III.  $\text{NH}_3$ , IV  $\text{CH}_3^+$   
 (A) I and II (B) III and IV  
 (C) I, II and III (D) II and IV

3. C

4. The bond angles of  $\text{NH}_3$ ,  $\text{NH}_4^+$  and  $\text{NH}_2^-$  are in the order  
 (A)  $\text{NH}_2^- > \text{NH}_3 > \text{NH}_4^+$  (B)  $\text{NH}_4^+ > \text{NH}_3 > \text{NH}_2^-$   
 (C)  $\text{NH}_3 > \text{NH}_2^- > \text{NH}_4^+$  (D)  $\text{NH}_3 > \text{NH}_4^+ > \text{NH}_2^-$

4. B

5. In which of the molecules below is the carbon-carbon distance the shortest?  
 (A)  $\text{H}_2\text{C} = \text{CH}_2$  (B)  $\text{C}_2\text{H}_2$   
 (C)  $\text{H}_3\text{C} - \text{CH}_3$  (D)  $\text{H}_2\text{C} = \text{C} - \text{CH}_2$

5. B

**(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. Which of the following substance(s) produce(s) gases on heating?  
 (A)  $\text{Ca}(\text{HCO}_3)_2$  (B)  $\text{Na}_2\text{CO}_3$   
 (C)  $\text{NaNO}_3$  (D)  $\text{KNO}_2$

6. AC

7. Which of the following elements are correctly arranged with respect to their second ionization energy?  
 (A)  $\text{O} > \text{N}$  (B)  $\text{B} > \text{C}$   
 (C)  $\text{Cu} > \text{Zn}$  (D)  $\text{C} > \text{Si}$

7. ABCD

COMMON TEST # 3 – C-XI-7

8. An atom contains 2, 8, 14 and 2 electrons respectively in K, L, M and N orbits. Which of the following statement(s) is/are correct for the atom?  
(A) it is a d-block element  
(B) it contains eight electrons with  $\ell = 0$   
(C) It's spin magnetic moment is  $2\sqrt{6}$  B.M  
(D) It contain no electron with  $l = 2$
8. ABC
9. Which of the following substance(s) is/are thermally less stable than  $\text{CaCO}_3$ ?  
(A)  $\text{BeCO}_3$  (B)  $\text{MgCO}_3$   
(C)  $\text{SrCO}_3$  (D)  $\text{BaCO}_3$
9. AB
10. Which of the following properties of compounds is correctly matched?  
(A) Hydration energy:  $\text{Li}^+ > \text{Na}^+ > \text{K}^+ > \text{Rb}^+ > \text{Cs}^+$   
(B) Solubility in water:  $\text{LiOH} < \text{NaOH} < \text{KOH} < \text{RbOH} < \text{CsOH}$   
(C) Lattice energy:  $\text{RbF} < \text{KF} < \text{NaF} < \text{LiF}$   
(D) Stability:  $\text{RbH} < \text{KH} < \text{NaH} < \text{LiH}$
10. ABCD
11. In which of the following molecules / ions, the central atom is  $\text{sp}^2$  hybridized?  
(A)  $\text{NH}_2^-$  (B)  $\text{BF}_3$   
(C)  $\text{NO}_2^-$  (D)  $\text{H}_2\text{O}$
11. BC
12. Highly pure dilute solution of sodium in liquid ammonia:  
(A) Shows blue colour  
(B) Exhibits electrical conductivity  
(C) Shows reducing properties  
(D) Shows oxidizing properties
12. ABC
13. Sodium sulphate is soluble in water whereas barium sulphate is sparingly soluble because  
(A) the hydration energy of sodium sulphate is more than its lattice energy  
(B) the lattice energy of barium sulphate is more than its hydration energy  
(C) the lattice energy has not role to play in solubility  
(D) the hydration energy of sodium sulphate is less than its lattice energy
13. AB

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. According to molecular orbital theory, the number of electrons present in the antibonding molecular orbitals of  $\text{N}_2^-$  is (are)
1. 5

**COMMON TEST # 3 – C-XI-8**

2. The dipositive(2+) ions of how many of the following atoms(s) contain(s) unpaired electrons?  
Li, Mg, Fe, Al, Cl, Ca, Zn, Ni, Ti, S, P and Si
2. 8
3. The number of d-orbitals involved in the formation of  $\text{PCl}_5$
3. 1
4. Find the maximum number of hydrogen bonds a water molecule can form
4. 4
5. What is the bond order in  $\text{NO}^+$ ?
5. 3

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*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 value of the expression  $\left(1 + \cos \frac{\pi}{10}\right)\left(1 + \cos \frac{3\pi}{10}\right)\left(1 + \cos \frac{7\pi}{10}\right)\left(1 + \cos \frac{9\pi}{10}\right)$  is
- (A)  $\frac{1}{8}$  (B)  $\frac{1}{16}$   
 (C)  $\frac{1}{4}$  (D) 0

1. **B**

2.  $f(\theta) = \sin^4 \theta + \cos^2 \theta$ , then range of  $f(\theta)$  is
- (A)  $\left[\frac{1}{2}, 1\right]$  (B)  $\left[\frac{1}{2}, \frac{3}{4}\right]$   
 (C)  $\left[\frac{3}{4}, 1\right]$  (D) None of these

2. **C**

3. The area of an equilateral triangle inscribed in the circle  $x^2 + y^2 - 2x = 0$  is
- (A)  $\frac{3\sqrt{3}}{4}$  (B)  $\frac{3\sqrt{3}}{2}$   
 (C)  $\frac{3\sqrt{3}}{8}$  (D) none

3. **A**

4. The radii of the circles  $x^2 + y^2 = 1$ ,  $x^2 + y^2 - 2x - 6y = 6$  and  $x^2 + y^2 - 4x - 12y = 9$  are in
- (A) A.P. (B) G.P.  
 (C) H.P. (D) None

4. **A**

5. If  $\frac{5\pi}{2} < x < 3\pi$ , then the value of the expression  $\frac{\sqrt{1 - \sin x} + \sqrt{1 + \sin x}}{\sqrt{1 - \sin x} - \sqrt{1 + \sin x}}$  is
- (A)  $-\cot \frac{x}{2}$  (B)  $\cot \frac{x}{2}$   
 (C)  $\tan \frac{x}{2}$  (D)  $-\tan \frac{x}{2}$

5. **D**

**(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. The value  $\frac{(\cos 11^\circ + \sin 11^\circ)}{(\cos 11^\circ - \sin 11^\circ)}$  is

- (A)  $-\tan 304^\circ$  (B)  $\tan 56^\circ$   
 (C)  $\cot 214^\circ$  (D)  $\cot 34^\circ$

6. **ABCD**

7. If  $\sin t + \cos t = \frac{1}{5}$  then  $\tan \frac{t}{2}$  is equal to:

- (A)  $-1$  (B)  $-\frac{1}{3}$   
 (C)  $2$  (D)  $-\frac{1}{6}$

7. **BC**

8. Which of the following lines have the intercepts of equal lengths on the circle,  $x^2 + y^2 - 2x + 4y = 0$ ?

- (A)  $3x - y = 0$  (B)  $x + 3y = 0$   
 (C)  $x + 3y + 10 = 0$  (D)  $3x - y - 10 = 0$

8. **ABCD**

9. Which of the following statement(s) is(are) correct?

- (A) If  $A = 130^\circ$  and  $S = \sin A + \cos A$ , then  $S > 0$   
 (B) If  $\operatorname{cosec}^2 30^\circ + k(\cos 36^\circ - \sin 18^\circ) = 5$ , then  $k$  equals 2  
 (C) The minimum value of  $27 \tan^2 \theta + 3 \cot^3 \theta$  is 18  
 (D) The value of  $\tan 20^\circ \tan 40^\circ \tan 60^\circ \tan 80^\circ$  is equal to 3

9. **ABCD**

10. If the equation  $x^2 + y^2 + 2\lambda x + 4 = 0$  and  $x^2 + y^2 - 4\lambda y + 8 = 0$  represent real circles then the value of  $\lambda$  can be

- (A) 1 (B) 2  
 (C) 3 (D) 5

10. **BCD**

11. If the equation of circle touching the  $y$ -axis at  $(0, 3)$  and making an intercept of 8 unit on  $x$ -axis is  $x^2 + y^2 + 2gx + 2fy + c = 0$ , then  $(g + f + c)$  can be

- (A) 1 (B) 7  
 (C) 11 (D) 14

11. **AC**

COMMON TEST # 3 – C-XI-11

12. If  $\tan x + \tan 2x + \tan 3x = 0$  then which of the following can be correct?

(A)  $\sec^2 x = 1$

(B)  $\cot^2 x = 2$

(C)  $\tan^2 x = 3$

(D)  $\operatorname{cosec}^2 x = 3$

12. ABCD

13. The equation of circle(s) which passes through  $(3, -6)$  and touches both axes is

(A)  $x^2 + y^2 - 6x + 6y + 9 = 0$

(B)  $x^2 + y^2 + 6x - 6y + 9 = 0$

(C)  $x^2 + y^2 + 30x - 30y + 225 = 0$

(D)  $x^2 + y^2 - 30x + 30y + 225 = 0$

13. AD

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.

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1. If  $a$  and  $b$  represent the intercepts made by the circle  $x^2 + y^2 - 5x - 13y - 14 = 0$  on  $y$ -axis and  $x$ -axis respectively, then  $|a - b|$  is equal to

1. 6

2. If  $A + B = 225^\circ$ , then the value of  $4 \cdot \left( \frac{\cot A}{1 + \cot A} \right) \cdot \left( \frac{\cot B}{1 + \cot B} \right)$  is

2. 2

3. The minimum value of  $10 \cos^2 x - 6 \sin x \cos x + 2 \sin^2 x$  for all real  $x$  is equal to

3. 1

4. The radius of the circle which passes through the points  $(1, 0)$ ,  $(-1, 0)$  and  $(0, 1)$  is

4. 1

5. The exact value of  $\operatorname{cosec} 10^\circ + \operatorname{cosec} 50^\circ - \operatorname{cosec} 70^\circ$  is equal to

5. 6

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Space for rough work