

FIITJEE INTERNAL TEST

COMMON TEST – III

Batches: One Year CRP(2122)

IIT- JEE 2022

Time: 3 hours

Maximum Marks: 186

- Please read the instructions carefully. You are allotted 5 minutes specially for this purpose.
- You are not allowed to leave the examination hall before end of the test.
- Use Blue/Black Ball Point Pen only for writing particulars on Side-1 and Side-2 of the Answer Sheet. Use to Pencil is strictly prohibited.

Instructions

Note:

1. The question paper contains 3 sections (Sec-1, Physics, Sec-II, Chemistry & Sec-III, Mathematics.)
2. Each section is divided into two parts, **Part-A and Part-B.**
3. **Part – A** contains 13 questions which are further divided as follows:
 - ❖ **Q. 1 – 5** are multiple choice questions. Each question has four choices (A), (B), (C) and (D), out of which **only one is correct.**
 - ❖ **Q. 6 – 13** are multiple correct answer type questions. Each question has four choices (A), (B), (C) and (D), out of which **one or more answer(s) is/are correct.**
4. **Part – B** contains 5 Numerical Based questions the answer of which maybe positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30).

Marking Scheme

1. For each question in the group **Q. 1 – 5 to Part – A** you will be awarded **3 marks** if you have darkened only the bubble corresponding to the answer and zero marks if no bubble is darkened. In all other cases, **minus one (-1) mark will be awarded.**
2. For each question in the group **Q. 6 – 13 of Part – A** contains 8 Multiple Choice Questions which have One or More Correct answer. Each question carries **+4 marks** for correct answer and **- 1 marks** for wrong 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.
3. **Part-B (01-05)** contains Six (05) Numerical based questions, the answer of which maybe positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30) and each question carries **+3 marks** for correct answer and **there will be no negative marking.**

Name of the Candidate :

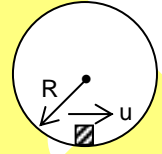
Enrolment Number :

Section – I (Physics)**PART – 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** option is be correct.

1. 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) $g\sqrt{6}$



1. **A**

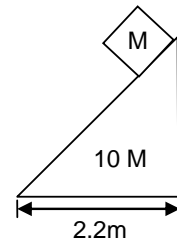
2. The relation between the displacement x and the time t for a body of mass 2kg moving under the action of a force is given by $x = \frac{t^3}{3}$, where x is in meters and t is in seconds. The work done by the body in the 1st 2 seconds is

(A) 1.6J (B) 16J
(C) 160J (D) 1600 J

2. **B**

3. A block of mass M is placed on the top of a bigger block of mass $10M$ as shown in figure. All the surfaces are frictionless. The system is released from rest, then the distance moved by the bigger block at the instant the smaller block reaches the ground:

(A) 0.22m (B) 0.20 m
(C) zero (D) 0.24 m



3. **B**

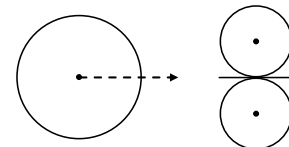
4. Four particle of mass $m_1 = 2m$, $m_2 = 4m$, $m_3 = m$ and m_4 are placed at four corners of a square. What should be the value of m_4 so that the centre of mass of all the four particles are exactly at the centre of the square?

(A) 2 m (B) 8 m (C) 6 m (D) none of these

4. **D**

5. Two equal discs initially at rest are in contact on a smooth horizontal table. A third disc of same mass but of double radius strikes them symmetrically and comes to rest after impact. the coefficient of restitution is

(A) $\frac{3}{4}$ (B) $\frac{9}{16}$ (C) $\frac{3}{16}$



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

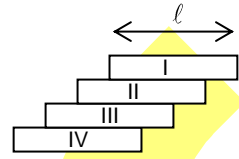
5. **B**

(Multiple 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. Four bricks each of length l are put on the top of one another in such a way that part of each extends beyond the one beneath. The largest equilibrium extension are

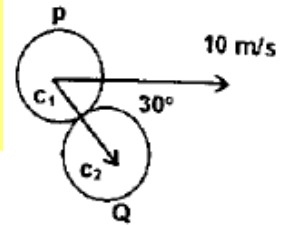
- (A) top brick over hanging the one below by $\frac{l}{2}$
 (B) second brick from top over hanging the one below $\frac{l}{4}$
 (C) third brick from top overhanging by bottom one by $\frac{l}{6}$
 (D) the total overhanging length on the edge of the bottom brick is $\frac{11}{12}l$



6. **ABCD**

7. A ball P collides elastically with another identical ball Q at rest with velocity 10 m/s at an angle of 30° from the line joining their centres c_1 and c_2 . Select the correct alternative(s)

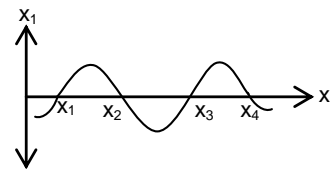
- (A) Velocity of ball P after collision is 5 m/s
 (B) Velocity of ball Q after collision is $5\sqrt{3} \text{ m/s}$
 (C) both the ball move at right angle after collision
 (D) kinetic energy will not be conserved since collision is not a head-on collision.



7. **ABC**

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

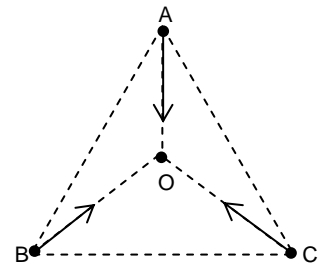
- (A) At x_1 & x_3 particle in stable equilibrium.
 (B) At x_1 & x_3 particle in unstable equilibrium.
 (C) At x_2 & x_4 particle in stable equilibrium.
 (D) At x_2 & x_4 particle in unstable equilibrium.



8. **BC**

9. Three particles A, B and C of equal masses move with equal speeds v along the medians of an equilateral triangle. After collision A comes to rest while B retraces its path with speed v . The velocity of C is then

- (A) V
 (B) direction \overrightarrow{OA}
 (C) $2V$
 (D) direction \overrightarrow{BO}



9. **AD**

10. Which one of the following statements are incorrect with reference to elastic collision between two bodies?

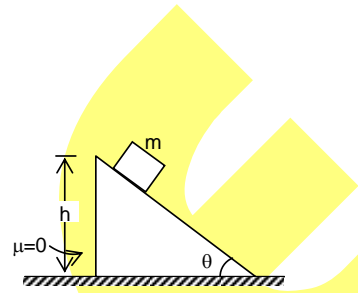
- (A) momentum and total energy are conserved but kinetic energy may change.
 (B) both kinetic energy and total energy are conserved but momentum may change.
 (C) both kinetic energy and momentum are conserved but total energy may change.
 (D) neither momentum nor kinetic energy are conserved but total energy must be conserved.

10. **BCD**

11. If the external forces acting on a system have zero resultant, the centre of mass
 (A) must not move (B) must not accelerate
 (C) may move (D) may accelerate

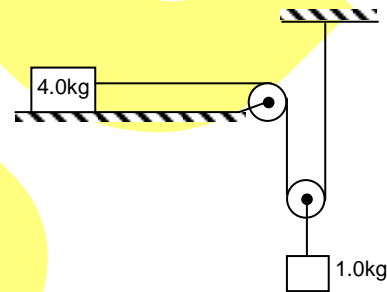
11. **BC**

12. A block of mass m is released from the top of a frictionless inclined wedge placed on a frictionless surface, then
 (A) the speed of the block at the bottom is less than $\sqrt{2gh}$
 (B) the speed of the block at the bottom is greater than $\sqrt{2gh}$
 (C) the speed of the block at the bottom is equal to $\sqrt{2gh}$
 (D) none of these



12. **A**

13. Considering the situation shown in the figure. The block of mass 1.0 kg is released from rest and it is found to have a speed of 0.3 m/s^{-1} after it has descended through a distance of 1 m. Which of the following statements are correct?
 (A) Loss in gravitational potential energy is 10J
 (B) kinetic energy of 1kg block is 0.045 J
 (C) 4 kg block travels a distance of 2 m to acquire a velocity of 0.6 ms^{-1}
 (D) Work done against friction is $80 \mu\text{J}$ where μ is coefficient of kinetic friction



13. **ABCD**

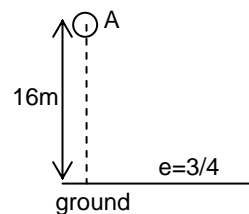
PART – B

This section contains 05 Numerical based questions, the answer of which maybe positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30)

1. A ball of mass m moving with a kinetic energy 3 J undergoes a head on elastic collision with another stationary ball of mass 2 m. During the impact, maximum change in potential energy of the system will be n Joule find n

1. **2**

2. A ball is dropped from a height of 16 m on a hard ground and after collision it bounces back to a height of “ h ” m. If coefficient of restitution $e = 3/4$ and $g = 10 \text{ m/s}^2$, then find value of h .

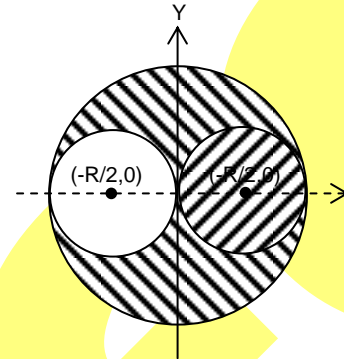


2. **9**

3. A particle of mass m is moving in a circular path of constant radius $r(0.5 \text{ m})$ such that its 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 $t = 5 \text{ sec.}$ (take $mk^2 = 1 \text{ unit}$)

3. **2.50**

4. Figure shows a uniform disc of radius R from which a hole of radius $R/2$ has been cut out from left of the centre and is placed on right of the centre of disc. The centre of mass of resulting disc is at a distance R/n from centre of uniform disc. Find the value of n



4. **4**

5. If an ideal linear spring is stretched by x then energy stored in it is E and when it is stretched by a further $1.5x$ then energy stored adds a further nE . Find the value of ' n '.

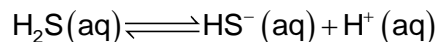
5. **5.25**

space for rough work

Section – II (Chemistry)**PART – 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** option is be correct.

1. Which of the following substance can increase the ionization of H_2S according to the following reaction?



- (A) HCl (B) KCN (C) NaCl (D) KNO_3

1. **B**

2. Which of the following compound is formed by heating hard water?

- (A) MgCl_2 (B) CaCO_3 (C) $\text{Ca}(\text{HCO}_3)_2$ (D) MgSO_4

2. **B**

3. Which of the following is the formula of a detergent?

- (A) RCOONa (B) $\text{RCH}_2\text{CH}_2\text{ONa}$ (C) RSO_3Na (D) $\text{RCH}_2\text{CH}_2\text{SNa}$

3. **C**

4. The first ionization constant of a weak dibasic acid H_2A is 10^{-5} . The pH of its 0.01 M NaHA salt solution is 6. What is its second ionization constant?

- (A) 10^{-8} (B) 10^{-9} (C) 10^{-7} (D) 10^{-12}

4. **C**

5. Which of the following substance can decolourise NO_2 ?

- (A) NaOH (B) Na_2SO_4 (C) NaNO_3 (D) NaCl

5. **A**

(Multiple 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) can form buffer with a limited quantity of HCl?

- (A) NaCN (B) NaHS (C) NaOH (D) NaNO_3

6. **AB**

7. $\text{IO}^- + \text{I}^- + \text{H}^+ \longrightarrow \text{Product(s)}$

The product(s) of above reaction is/are

- (A) I_2 (B) IO_3^- (C) OH^- (D) IO_4^-

7. **AC**

8. Which of the following substance(s) is/are obtained after prolonged electrolysis of water?

- (A) H_2 (B) H_2O_2 (C) O_2 (D) D_2O

8. **ACD**

9. The solubility of a sparingly soluble compound $M(OH)_3$ in water is 0.01 mol L^{-1} . Choose correct statement(s) regarding the compound? [$\log 3 = 0.477$]
 (A) The solubility product (K_{sp}) of the compound is 27×10^{-8}
 (B) The pH of its saturated solution is 12.47
 (C) The solubility of the hydroxide at pH = 6 is $27 \times 10^{16} \text{ mol L}^{-1}$
 (D) The solubility product (K_{sp}) becomes 27×10^{-10} at pH = 12

9. **ABC**

10. Which of the following statement(s) is/are correct for BeH_2 ?
 (A) It exists in polymeric form
 (B) It is a covalent hydride
 (C) Its polymer contains $3c - 2e$ bonds
 (D) Its monomer is an electron deficient compound

10. **ABCD**

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

11. **A**

12. In which of the following solvent/solution, $AgCl$ is more soluble than in water?
 (A) 0.01 M $NaCl$ (B) 0.1 M NH_4OH (C) 0.1 M $AgNO_3$ (D) 0.01 M KCN

12. **BD**

13. 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

13. **ABC**

PART – B

This section contains 05 Numerical based questions, the answer of which maybe positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30)

1. What is the pH of a buffer which contains 0.2 M of a weak acid HA and 0.02 M of its salt NaA ? [K_a of $HA = 10^{-6}$]

1. **5**

2. What is the pH of 0.01 N $NaNO_3$ solution at room temperature?

2. **7**

3. What is the pH of 10^{-6} M KCN solution?
 [K_a of $HCN = 10^{-10}$]

3. **9**

4. How many water of crystallization molecules are present in plaster of paris?

4. **0.5**

5. How many total no. of moles of gases are formed by completely heating one moles of LiNO_3 ?

5. 1.25

space for rough work

Section – III (Mathematics)

PART – 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** option is be correct.

1. The value of $\int e^{\tan^{-1}x} \left(\frac{1+x+x^2}{1+x^2} \right) dx$ is equal to :
- (A) $x e^{\tan^{-1}x} + C$ (B) $x^2 e^{\tan^{-1}x} + C$
 (C) $\frac{1}{x} e^{\tan^{-1}x} + C$ (D) none of these

1. **A**

2. The value of $\int \frac{\sqrt{\tan x}}{\sin x \cos x} dx$ is equal to
- (A) $2\sqrt{\tan x} + C$ (B) $2\sqrt{\cot x} + C$
 (C) $\frac{\sqrt{\tan x}}{2} + C$ (D) none of these

2. **A**

3. If $\int \frac{1}{1+\sin x} dx = \tan\left(\frac{x}{2} + a\right) + b$, then
- (A) $a = -\frac{\pi}{4}, b \in \mathbb{R}$ (B) $a = \frac{\pi}{4}, b \in \mathbb{R}$
 (C) $a = \frac{5\pi}{4}, b \in \mathbb{R}$ (D) none of these

3. **A**

4. $\int_0^1 \frac{\tan^{-1} x}{1+x^2} dx$ is equal to
- (A) $\frac{\pi}{4}$ (B) $\frac{\pi^2}{32}$
 (C) 1 (D) None

4. **A**

5. If $I = \int_0^1 \frac{dx}{(1+x)(2+x)\sqrt{x(1-x)}}$, then I equals
- (A) 2π (B) π
 (C) $\frac{\pi}{2}$ (D) $\frac{\pi}{\sqrt{6}}(\sqrt{3}-1)$

5. **D**

(Multiple 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 is/are correct?

$$(A) \int \sqrt{x^2 + a^2} dx = \frac{x}{2} \sqrt{x^2 + a^2} + \frac{a^2}{2} \ln \left| x + \sqrt{x^2 + a^2} \right| + c$$

$$(B) \int \sqrt{x^2 + a^2} dx = \frac{x}{2} \sqrt{x^2 + a^2} + \frac{a^2}{2} \ln \left| \frac{x + \sqrt{x^2 + a^2}}{a} \right| + c$$

$$(C) \int \operatorname{cosec} x dx = \ln \left| \sin \frac{x}{2} \right| - \ln \left| \cos \frac{x}{2} \right| + c$$

(D) All the above

6. **ABCD**

7. $\int \frac{dx}{1+x^2}$ is equal to

$$(A) \tan^{-1} x + C$$

$$(B) \frac{\pi}{2} - \cot^{-1} x + C$$

$$(C) -\cot^{-1} x + C$$

$$(D) \ln(1+x^2) + C$$

7. **ABC**

8. $\int e^{\ln x^2} dx$ is equal to

$$(A) e^{\frac{\ln x^3}{3}} + C$$

$$(B) \frac{x^3}{3} + C$$

$$(C) \frac{e^{\ln x^2}}{2x} + C$$

$$(D) \frac{(x^2)^2}{2} + C$$

8. **AB**

9. $\int \frac{dx}{x(x^4-1)}$ equals

$$(A) \ln \left| 1 - \frac{1}{x^4} \right| + C$$

$$(B) \frac{1}{4} \ln \left| 1 - \frac{1}{x^4} \right| + C$$

$$(C) \frac{1}{8} \ln \left| \frac{x^8 - 2x^4 + 1}{x^8} \right|$$

$$(D) \ln |x^4 - 1| + C$$

9. **BC**

10. The value of integral $\int_0^{\frac{\pi}{2}} \ln \sin x \, dx$ is equal to

(A) $\int_0^{\frac{\pi}{2}} \ln \cos x \, dx$

(B) $\int_0^{\frac{\pi}{2}} \ln \sin 2x \, dx$

(C) $-\frac{\pi}{2} \ln 2$

(D) $\frac{\pi}{2} \ln \frac{1}{2}$

10. **ABCD**

11. Which of the following is/are correct?

(A) $\int_0^{\frac{\pi}{2}} \frac{\cos x}{\cos x + \sin x} \, dx = \frac{\pi}{4}$

(B) $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{dx}{1 + \sqrt{\tan x}} = \frac{\pi}{6}$

(C) $\int_0^{\frac{\pi}{2}} \cos(\pi \sin^2 x) \, dx = 0$

(D) $\int_0^a \frac{f(x)}{f(x) + f(a-x)} \, dx = \frac{a}{2}$

11. **ACD**

12. Which of the following is correct?

(A) $\int_0^{2\pi} \sin x \, dx = 0$

(B) $\int_0^{100\pi} \sin x \, dx = 0$

(C) $\int_0^{41\pi} \sin x \, dx = 0$

(D) $\int_0^{6\pi} \sin x \, dx = 0$

12. **ABD**

13. Let $F(x) = \int_0^x (t-1)(t-2)^2 \, dt$, then

(A) $\left(1, -\frac{17}{12}\right)$ is a point of minimum

(B) $\left(2, \frac{-4}{3}\right)$ is a point of inflexion

(C) $\left(\frac{4}{3}, \frac{-112}{81}\right)$ is a point of inflexion

(D) $(1, -3)$ is a point of minimum

13. **ABC**

PART – B

This section contains 05 Numerical based questions, the answer of which may be positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30)

1. If $\int \frac{x}{(x-1)(x-2)(x-3)} \, dx = k_1 \ln|x-1| + k_2 \ln|x-2| + k_3 \ln|x-3| + C$ then $k_1 + k_2 + k_3$ is equal to

1. **0**

2. If $\int_0^{\pi/3} \frac{\cos x}{3+4\sin x} dx = K \log\left(\frac{3+2\sqrt{3}}{3}\right)$, then K is:

2. 0.25

3. If $\int \frac{dx}{3\cos x + 4\sin x + 5} = \frac{1}{5} \tan\left(\frac{x - \tan^{-1} \alpha}{2}\right) + C$, then $\left|\frac{4}{\alpha}\right|$ is equal to

3. 3

4. Let f be a positive function, and $I_1 = \int_{1-k}^k x f\{x(1-x)\} dx$, $I_2 = \int_{1-k}^k f\{x(1-x)\} dx$, where $2k-1 > 0$, then $\frac{I_1}{I_2}$ is:

4. 0.50

5. If $\int_0^x f(t) dt = x + \int_x^1 t f(t) dt$, then the value of f(1) is:

5. 0.50

space for rough work

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COMMON TEST – III

Batches:

IIT- JEE 2022

ANSWERS

SECTION – I (Physics)

Part – A

Part – B

SECTION – II (Chemistry)

Part – A

Part – B

SECTION – III (Mathematics)

Part – A

Part – B