

PHYSICS, CHEMISTRY & MATHEMATICS**QP Code: 100689****RIT- II****Time Allotted: 3 Hours****Maximum Marks: 198**

- 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 Sections**.
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-B** in the OMR.
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 Two Parts.

- (i) **Part-A (01-06)** – Contains seven (06) multiple choice questions which have **One or More** correct answer.
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: -2 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 **-2 marks**, as a wrong option is also darkened.
- (ii) **Part-B (01-06)** contains Six (06) Numerical based questions with single digit integer as answer, ranging from 0 to 9 (both inclusive) and each question carries **+3 marks** for correct answer and **-1 marks** for wrong answer.
- (iii) **Part-B (07-12)** contains Six (06) Numerical based questions, the answer of which maybe positive or negative numbers or decimals to **Two decimal places** (e.g. 6.25, 7.00, -0.33, -30, 30.27, -127.30) and each question carries **+4 marks** for correct answer and **there will be no negative marking**.

Name of the Candidate: _____

Batch: _____ Date of Examination: _____

Enrolment Number: _____

BATCHES – Two Year CRP – 2325

SECTION-1 : PHYSICS

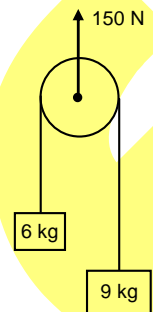
PART – A

(Multi Correct Choice Type)

This section contains 6 **multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

1. As situation shown in figure, choose the correct option(s)
(take $g = 10 \text{ m/s}^2$ downward)

- (A) the acceleration of pulley is $\frac{5}{6} \text{ m/s}^2$ upward.
(B) the acceleration of pulley is $\frac{5}{12} \text{ m/s}^2$ upward.
(C) the acceleration of pulley is 0.
(D) tension in the string which connects the masses is 75 N.



2. Two masses $M_A = 1 \text{ kg}$ and $M_B = 2 \text{ kg}$ are connected by a massless spring as shown in figure. A force of 4 N acts on the 2 kg mass.

- (A) when acceleration of A is 1 m/s^2 the acceleration of B is $\frac{3}{2} \text{ m/s}^2$

- (B) when acceleration of A is $\frac{4}{3} \text{ m/s}^2$ the acceleration of B is $\frac{4}{3} \text{ m/s}^2$

- (C) the acceleration of A always be less or equal to the acceleration of B
(D) none of these

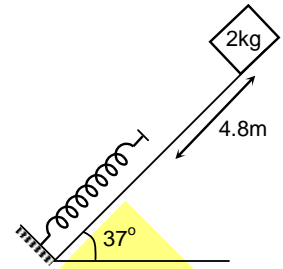


3. Which of the following statement(s) is/are incorrect?

- (A) Friction force always acts opposite to the net applied force
(B) If net force on a body is zero, its acceleration will be same in all frames
(C) A person is pushing a box. The force exerted by box on person is less than the force by person on box.
(D) A moving object can move with a constant velocity by a push less than the limiting static friction.

Space For Rough Work

4. Figure shows a massless spring fixed at the bottom end of an inclined of inclination 37° ($\tan 37^\circ = 3/4$). 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 ($g = 10 \text{ m/s}^2$)



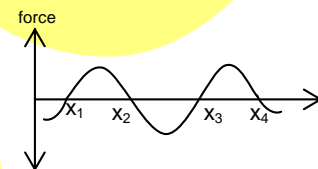
- (A) coefficient of friction between block and inclined is 0.5.
 (B) coefficient of friction between block and inclined is 0.75.
 (C) value of spring constant is 1000 N/m.
 (D) value of spring constant is 2000 N/m.

5. Two blocks A and B are placed rough horizontal surface and are connected by a string. If two unequal force F_1 & F_2 are applied ($F_1 > F_2$) on block A and B in opposite direction. Choose the correct alternatives.



- (A) friction on both the blocks act leftward
 (B) friction on B always act leftward
 (C) friction on A may have any direction i.e. left or right
 (D) tension on the string may be zero

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

PART – B

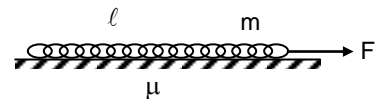
Integer Answer Type

This section contains **6 questions**. The answer to each of the questions is a single digit integer, ranging from **0 to 9**.

1. A block of 7 kg is placed on a rough horizontal surface and is pulled through a variable force F (in N) = $5t$, where t is time in second, at an angle of 37° with the horizontal as shown in figure. The coefficient of static friction of the block with the surface is one. If the force starts acting at $t = 0$ s, if the time (in sec) at which the block starts to slide is found to be $10n$. Find the value of n . (Take $g = 10 \text{ m/s}^2$)

Space For Rough Work

2. A chain of mass 10 kg and length 8 m is resting on a rough horizontal surface ($\mu = 0.2$). A force $F = 15$ N is applied as shown. Find the length (in m) of the chain on which no friction force acts.

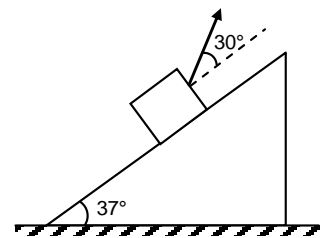


3. A uniform chain of length ℓ and mass m overhangs a smooth table with its two third part lying on the table. If the kinetic energy of the chain as it completely slips off the table is $\frac{4}{x}mgl$, then find the value of 'x'.
4. A particle of mass m is moving in a circular path of constant radius $r(1\text{m})$ 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 $t = 5$ sec. (take $mk^2 = 1$ unit)
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 $\frac{ma^2t^2}{x}$, then find the value 'x'.
6. A block is moving on an inclined plane making an angle 45° with the horizontal and the coefficient of friction is μ . The force required to just push it up the inclined plane is three times the force required to just prevent it from sliding down. If we define $N = 10\mu$, then N is

PART – B (Numerical Type)

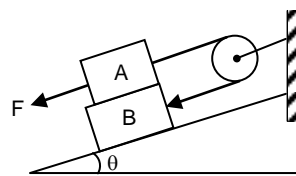
This section contains **6 questions**, numerical based questions, (answer of which maybe positive or negative numbers or decimals to **Two decimal places**).

7. A block of mass 1 kg lies on a horizontal surface in a truck. The coefficient of static friction between the block and the surface is 0.6. If the acceleration of the truck is 4.56 m/s^2 , then what frictional force acting on the block (in newton).
8. A block of mass $m = 4$ kg is placed over a rough inclined plane as shown in figure. The coefficient of friction between the block and the plane is $\mu = 0.5$. A force $F = 10$ N is applied on the block at an angle of 30° . Find the contact force (in N) between the block and the plane.

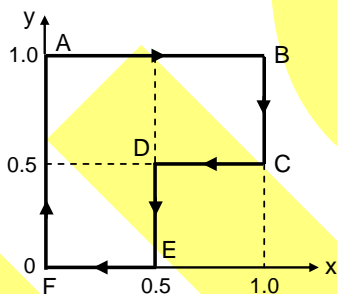


Space For Rough Work

9. Block A has a mass of 30 kg and block B a mass of 15 kg. The coefficients of friction between all surfaces of contact are $\mu_s = 0.15$ and $\mu_k = 0.10$. Knowing that $\theta = 30^\circ$ and that the magnitude of the force F applied to block A is 250 N, determine the acceleration of block A (in m/s^2).



10. A man slowly pulls a bucket of water from a well of depth $h = 20$ m. The mass of the uniform rope and bucket full of water are $m = 200$ g and $M = 19.9$ kg, respectively. Find the work done (in kJ) by the man.
11. The PE of a certain spring when stretched from natural length through a distance 0.3 m is 5.6 J. Find the amount of work in joule that must be done on this spring of stretch it through an additional distance 0.15 m.
12. A particle is moved along a path AB-BC-CD-DE-EF-FA, as shown in figure, in presence of a force $\vec{F} = (\alpha y \hat{i} + 2\alpha x \hat{j})\text{N}$, where x and y are in meter and $\alpha = -1 \text{ N m}^{-1}$. The work done on the particle by this force \vec{F} will be _____ Joule.



Space For Rough Work

SECTION-2 : CHEMISTRY**PART – A****(Multi Correct Choice Type)**

This section contains 6 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

- The condition(s) for ionic bond is/are
(A) low ionization energy of metal which forms cation
(B) high electron affinity of non-metal which form anion
(C) high lattice energy of the compound which is formed
(D) high sublimation energy of the metal forming cation
- Which contain(s) sigma as well as pi-bonds?
(A) O₂
(B) N₂
(C) H₂
(D) F₂
- Which of the following properties varie(s) in the given order:
 $C^{4-} > N^{3-} > O^{2-} > F^{-}$
(A) proton to electron ratio
(B) ionic radius
(C) $\frac{1}{Z^*}$ (Z^* = Effective nuclear charge towards valence electron)
(D) number of orbitals occupied by electrons
- Which reaction(s) of lithium is/are not given by the other elements of its group?
(A) $6Li + N_2 \longrightarrow 2Li_3N$
(B) $2LiOH \longrightarrow Li_2O + H_2O$
(C) $4LiNO_3 \longrightarrow 2Li_2O + 4NO_2 + O_2$
(D) $Li_2O + H_2O \longrightarrow 2LiOH$
- Which of the following is/are more electronegative than nitrogen?
(A) O
(B) F
(C) C
(D) P
- Which of the following substance(s) form H₂ gas when react(s) with water.
(A) KH
(B) Na
(C) HCl
(D) NaCl

Space For Rough Work

PART – B

Integer Answer Type

This section contains **6 questions**. The answer to each of the questions is a single digit integer, ranging from **0 to 9**.

- The molecular orbital electronic configuration of O_2 is
 $\sigma_{1s}^2 \sigma_{1s}^{*2} \sigma_{2s}^2 \sigma_{2s}^{*2} \sigma_{2p_z}^2 \pi_{2p_x}^2 = \pi_{2p_y}^2 \pi_{2p_x}^{*1} = \pi_{2p_y}^{*1} \sigma_{2p}^*$
 If x = number of nodal planes of **one of the HOMO**(Highest occupied molecular orbital)
 y = number of nodal planes of the LUMO(Lowest unoccupied molecular orbital)
 z = bond order of O_2^{2-} ion
 then the value of $(x + y + z)$ is
- XeF_4 shows two geometrical isomers(X) and (Y). The dipole moment of the stable isomer(X) is zero and that of unstable isomer(Y) is non-zero. If the two lone pairs in isomer(X) make an angle a° and its bond angle is b° , what is the value of $\left(\frac{a+b}{30}\right)$?
- Among the different halides of group-1 metals, (X) is the halide with the highest lattice energy. If the molar mass of (X) is 'a' gram mol^{-1} , what is the value of $\left(\frac{a}{13}\right)$?
- $Cs \xrightarrow{O_2} (P) \xrightarrow{H_2O} Q + R + S \uparrow$
 (Major Product)
 If x = the number of unknown compound(s) which are used as oxidizing agents.
 y = the number of unknown product(s) that contain(s) polar as well as non-polar covalent bonds.
 z = the number of unknown product(s) which are paramagnetic.
 a = the number of unknown products containing sigma and pi-bonds.
 What is the value of $(x + y + z + a)$?
- The outermost electrons of O_2 molecule, i.e., the electrons of π^* orbitals can be arranged in three different ways.

	π_x^*	π_y^*
1.	\uparrow	\uparrow
2.	\uparrow	\downarrow
3.	$\uparrow\downarrow$	

 If the spin multiplicity of the states 1, 2 and 3 are x , y and z , what is the value of $(x + y + z)$?

Space For Rough Work

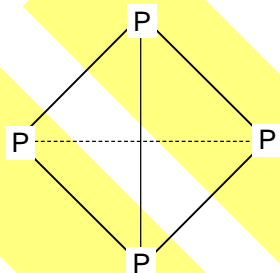
6. How many electron deficient species are there in the following list?

BeF₂, BF₃, CF₄, NF₃, $\overset{\ominus}{\text{CF}}_3$, $\overset{\oplus}{\text{CH}}_3$, $\overset{\ominus}{\text{CH}}_3$, H⁺, NH₂⁻, N³⁻, PCl₅, SF₄, BeCl₂(solid state), BeCl₂(gaseous state)

PART – B (Numerical Type)

This section contains **6 questions**, numerical based questions, (answer of which maybe positive or negative numbers or decimals to **Two decimal places**).

7. The sum of bond orders of O₂, O₂⁺ & O₂²⁻ is
8. Element X belongs to the second period of periodic table. X can be easily ionized to X⁺ ions than its diatomic X₂ molecules. If the p-orbitals of X⁺ ion contain two electrons, what is the bond order of X₂⁺ ion?
9. In H₂O
 x = the number of hybridized orbitals of oxygen
 y = the number of lone pairs present on central atom
 z = the number of O – H bonds
 The value of $\left(\frac{x+y+z}{5}\right)$
10. $\text{NaOH} \xrightarrow[\text{Cold}]{\text{Cl}_2} (\text{P}) + (\text{Q}) + \text{H}_2\text{O}$
 $\text{NaOH} \xrightarrow[\text{Hot}]{\text{Cl}_2} (\text{R}) + (\text{Q}) + \text{H}_2\text{O}$
 In above reaction, what is the ionic mass of the anion of (R) in g mol⁻¹ unit?
11. The first ionization energy and electron affinity of an atom is 3.8 and 2 eV respectively. What is the electronegativity of the atom in Mulliken scale?
12. The structure of P₄ is



If 'x' is the number of hybridized orbitals formed by all the 'P' atoms in P₄ molecule, 'y' is the number of non-bonding electrons present in the outermost orbits of all P atoms in P₄, z is the number of P – P bond present in P₄, then what is the value of $\left(\frac{x+2y+3z}{20}\right)$?

Space For Rough Work

SECTION-3 : MATHEMATICS

PART – A

(Multi Correct Choice Type)

This section contains 6 **multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

1. The equation of a line passing through the point of intersection of the line, $x - 2y = 3$ and $x + 3y = 8$ having equal intercept on the co – ordinate axes is:
 (A) $x + y = 6$ (B) $x - 5y = 0$
 (C) $5x - y = 0$ (D) $x + y = 5$
2. The equation of the circle that touches the axis of 'X' at a distance 3 from the origin and intercepts a length 6 on the axis of 'Y' is
 (A) $x^2 + y^2 + 6x - 6\sqrt{2}y + 9 = 0$ (B) $x^2 + y^2 - 6x - 6\sqrt{2}y + 9 = 0$
 (C) $x^2 + y^2 - 6x + 6\sqrt{2}y + 9 = 0$ (D) $x^2 + y^2 + 6x + 6\sqrt{2}y + 9 = 0$
3. The lines $x + y = 1$, $(\mu - 1)x + (\mu^2 - 7)y - 5 = 0$, $(\mu - 2)x + (2\mu - 5)y = 0$ are:
 (A) concurrent for three distinct real value μ
 (B) concurrent for no real value of μ
 (C) parallel for one real value of μ
 (D) parallel for two real value of μ
4. A circle passes through the point (1, 1) and (2, 2) and its radius is 1. The coordinates of the centre of the circle are:
 (A) (1,2) (B) (2,1) (C) $\left(\frac{3}{2}, \frac{3}{2}\right)$ (D) (1, 0)
5. Consider two lines, $L_1 : 2x + y + 4 = 0$ and $L_2 : 2x + 4y + 5 = 0$, then:
 (A) Bisector of angle containing origin is $2x - 2y + 13 = 0$
 (B) Bisector of acute angle is $6x + 6y + 13 = 0$
 (C) Angle containing origin is acute angle
 (D) Angle containing origin is obtuse
6. A circle touches the straight lines $x + y = 2$, $x - y = 2$ and also the circle $x^2 + y^2 = 1$. The radius of the circle can be equal to:
 (A) $\sqrt{2} + 1$ (B) $3(\sqrt{2} - 1)$ (C) $3(\sqrt{2} + 1)$ (D) $\sqrt{2} - 1$

Space For Rough Work

PART – B

Integer Answer Type

This section contains **6 questions**. The answer to each of the questions is a single digit integer, ranging from **0 to 9**.

1. If the equation $(x + y - 4)^2 - (x + 7y - 7)(ax + by + 1) = 0$ represents a circle, then the value $25(a^2 + b^2)$ is equal to _____.
2. Find the area of the triangle formed by the line $x + y = 3$ and the angle bisectors of pair of straight lines $x^2 - y^2 + 2y = 1$.
3. Let x , y and z be the lengths of perpendiculars dropped from the circumcentre of a triangle ABC to its sides BC, CA and AB respectively. Then $\frac{abc}{xyz} \left[\frac{a}{x} + \frac{b}{y} + \frac{c}{z} \right]^{-1}$ is equal to _____
(a , b , c are the lengths of the sides BC, CA and AB respectively).
4. Consider a $\triangle ABC$ formed by lines $L_1 : x + y = 30$; $L_2 : y - x = 12$ and $L_3 : x - 3y = 30$. If the point (a, a^2) lies in or on the triangle then find the sum of all possible integral values of a .
5. Let $A_0 A_1 A_2 A_3 A_4 A_5$ be a regular hexagon inscribed in a unit circle. The sum of the squares of the lengths of the line segments $A_0 A_1$, $A_0 A_2$ and $A_0 A_4$ is equal to _____
6. Consider a family of lines $(2\lambda + 1)x - (\lambda + 1)y + 1 - 2\lambda = 0$, if the minimum area of lines which a member of this family with negative gradient can make with the positive axes is A , find $\frac{A}{6}$.

PART – B

(Numerical based)

This section contains **6 questions**, numerical based questions, (answer of which maybe positive or negative numbers or decimals to **Two decimal places**).

7. If the equation of the circle whose radius is 5 and which touches the circle $x^2 + y^2 - 2x - 4y - 20 = 0$ at the points $(5, 5)$ is $(x - h)^2 + (y - k)^2 = 25$, then the value of $\frac{h^2 + k^2}{10}$ must be _____

Space For Rough Work

8. The square of the length of the tangent drawn from any point on the circle $x^2 + y^2 + 70x - 45y + 6789 = 0$ to the circle $x^2 + y^2 + 70x - 45y + 9876 = 0$ is P then $\frac{P}{100}$ _____
9. Two circles of radii 4 cm and 1 cm touch each other externally and θ is the angle contained by their direct common tangents. Then $\sin \theta =$ _____
10. If the equation $4y^3 - 8a^2yx^2 - 3ay^2x + 8x^3 = 0$ represent three straight lines, two of them are perpendicular and sum of all possible values of a is equal to s then $|s|$ _____
11. Consider 3 lines
 $L_1 : 5x - y + 4 = 0$
 $L_2 : 3x - y + 5 = 0$
 $L_3 : x + y + 8 = 0$
If these lines enclose a triangle ABC and sum of the squares of the tangent of the interior angles can be expressed in the form $\frac{p}{q}$ where p and q are relatively prime numbers, compute the value of $\frac{(p+q)}{10}$.
12. If centroid of a triangle be (1, 4) and the co – ordinate of its any two vertices are (4, -8) and (-9, 7), then the area of the triangle is: _____

Space For Rough Work

BATCHES – Two Year CRP-2325

RIT – II

Code : 100689

ANSWERS

SECTION-1 : PHYSICS

PART – A

- | | | | |
|--------|-------|--------|-------|
| 1. BD | 2. AB | 3. ABC | 4. AC |
| 5. BCD | 6. BC | | |

PART – B

- | | | | |
|---------|----------|----------|----------|
| 1. 1 | 2. 2 | 3. 9 | 4. 5 |
| 5. 8 | 6. 5 | 7. 4.56 | 8. 30.20 |
| 9. 5.20 | 10. 4.00 | 11. 7.00 | 12. 0.75 |

SECTION – 2 : CHEMISTRY

PART – A

- | | | | |
|--------|-------|-------|--------|
| 1. ABC | 2. AB | 3. BC | 4. ABC |
| 5. AB | 6. AB | | |

PART – B

- | | | | |
|--------|----------|---------|---------|
| 1. 6 | 2. 9 | 3. 2 | 4. 5 |
| 5. 5 | 6. 6 | 7. 5.5 | 8. 2.5 |
| 9. 1.6 | 10. 83.5 | 11. 2.9 | 12. 2.5 |

SECTION – 3 : MATHEMATICS

PART – A

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|--------|---------|-------|-------|
| 1. AB | 2. ABCD | 3. BC | 4. AB |
| 5. ABC | 6. ABCD | | |

PART – B

- | | | | |
|---------|----------|----------|-----------|
| 1. 2 | 2. 2 | 3. 4 | 4. 4 |
| 5. 7 | 6. 4 | 7. 14.50 | 8. 30.87 |
| 9. 0.96 | 10. 0.75 | 11. 4.65 | 12. 166.5 |