

# FIITJEE RESHUFFLING TEST

Batches: NWTR618X01,G01,A01-A05, CAMP618, NWTW618A01-A05,G01,B01-B08,  
NWTR618B01-B02, PIN618-XIC, PAINI618-G1 & PANINI618-XI1-XI3

## IIT-JEE (Mains), 2018

(PHASE – 1+2+3)

Paper Code  
**102912**

Time: 3 hour

Maximum Marks: 360

- Please read the instructions carefully.
- You are not allowed to leave the examination hall before end of the test.

### Instructions

#### (A) General

1. This booklet is your Question Paper.
2. This Question Paper contains **90 questions**. Attempt ALL the questions.
3. The Question Paper contains blank spaces for your rough work. No additional sheets will be provided for rough work.
4. Blank papers, clip boards, log tables, slide rule, calculators, cellular phones, pagers and electronic gadgets, in any form, are **NOT** allowed.
5. Write your **Name** and **Enrollment No.** in the space provided at the bottom of this sheet.

#### (B) Filling in the OMR

6. On the OMR, write in ink your Name, Enrollment No., name of the centre and put your signature in the appropriate boxes.
7. All question are single correct.
8. On the OMR, for each question number, darken **ONLY one** bubble with HB pencil only corresponding to what you consider to be the most appropriate answer, from among the four choices.

#### (C) Marking Scheme

- (i) Each questions of **Part A, B & C** carries **4 Marks**.
- (ii) In case of wrong answer you will be awarded **-1 mark** for that question.
- (iii) In case you have not darkened any bubble you will be awarded **0 mark** for that question.

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Name of the Candidate : .....

Enroll. Number : .....

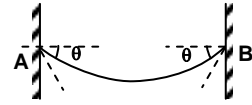
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**Physics****PART – A****(Single Correct Choice Type)**

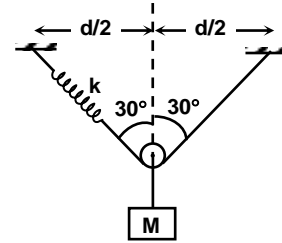
This section contains **30 multiple choice questions**. Each question has four choice (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

1. A heavy string of mass  $m$  hangs between two fixed points A and B at an angle  $\theta$  with the horizontal as shown in the figure. The tension at the lowest point in the string is
- (A)  $mg/(2 \sin \theta)$  (B)  $mg/(2 \cos \theta)$   
 (C)  $mg/(2 \tan \theta)$  (D)  $mg/(2 \cot \theta)$



2. The system shown in the figure is in equilibrium. Now if  $M$  is given a slight vertical displacement, what will be the time period of resulting oscillations?

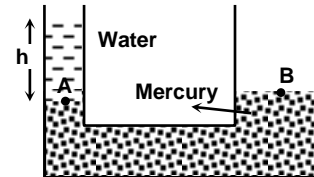
- (A)  $2\pi \sqrt{\frac{M}{k}}$  (B)  $2\pi \sqrt{\frac{M}{3k}}$   
 (C)  $2\pi \sqrt{\frac{3M}{k}}$  (D)  $2\pi \sqrt{\frac{2M}{k}}$



3. Consider a uniform square plate of side 'a' and mass 'm'. The moment of inertia of this plate about an axis perpendicular to its plane and passing through one of its corners is
- (A)  $\frac{5}{6} ma^2$  (B)  $\frac{1}{12} ma^2$   
 (C)  $\frac{7}{12} ma^2$  (D)  $\frac{2}{3} ma^2$

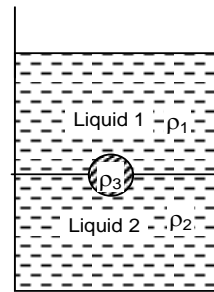
4. Two communicating vessels contain mercury. The diameter of one vessel is  $n$  times larger than the diameter of the other. A column of water of height  $h$  is poured into the left vessel. The mercury level will rise in the right-hand vessel ( $s$  = relative density of mercury and  $\rho$  = density of water)

- (A)  $\frac{n^2 h}{(n+1)^2 s}$  (B)  $\frac{h}{(n^2 + 1)s}$   
 (C)  $\frac{h}{(n+1)^2 s}$  (D)  $\frac{h}{n^2 s}$



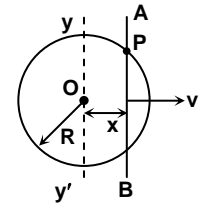
**Space for rough work**

5. A jar filled with two non mixing liquids 1 and 2 having densities  $\rho_1$  and  $\rho_2$  respectively. A solid ball, made of a material of density  $\rho_3$ , is dropped in the jar. It comes to equilibrium in the position shown in the figure.



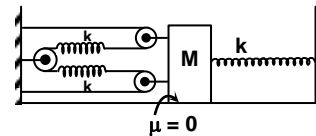
- Which of the following is true for  $\rho_1$ ,  $\rho_2$  and  $\rho_3$ ?
- (A)  $\rho_3 < \rho_1 < \rho_2$   
 (B)  $\rho_1 = \rho_3 < \rho_2$   
 (C)  $\rho_1 < \rho_2 < \rho_3$   
 (D)  $\rho_1 < \rho_3 < \rho_2$

6. A rod AB is moving on a fixed circle of radius R with constant velocity  $v$  as shown in the figure. At an instant the rod is at a distance  $x = 4R/5$  from the centre of the circle. The angular speed of the point of intersection P with respect to the centre of circle is (The rod is always parallel to  $yy'$  and its velocity is always perpendicular to its length)



- (A)  $\frac{5v}{4R}$  (B)  $\frac{5v}{3R}$   
 (C)  $\frac{v}{R}$  (D)  $\frac{v}{2R}$

7. A block of mass M is attached with the springs as shown. If the block is slightly displaced, the time period of SHM for the block shown in the figure will be

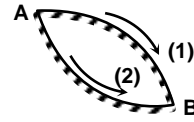


- (A)  $2\pi\sqrt{\frac{m}{9k}}$  (B)  $2\pi\sqrt{\frac{m}{k}}$   
 (C)  $\frac{4\pi}{3}\sqrt{\frac{m}{k}}$  (D)  $\pi\sqrt{\frac{m}{2k}}$

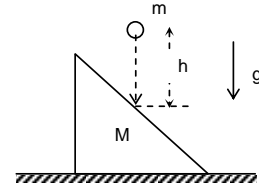
8. An ideal gas has initial volume V and pressure P. In doubling its volume the minimum work done will be in the following process (of given processes)
- (A) Isobaric process (B) Isothermal process  
 (C) Adiabatic process (D) None of the above

**Space for rough work**

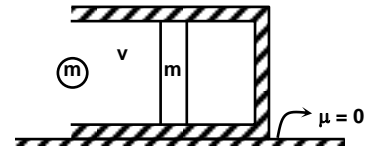
9. A small body slides from rest along two equally rough circular surfaces from A to B through path 1 and 2 of equal radius if  $v_1$  and  $v_2$  are the speed of the block at point B via path (1) and (2), then
- (A)  $v_1 > v_2$  (B)  $v_1 < v_2$   
 (C)  $v_1 = v_2$  (D) can't be predicted



10. A small ball of mass  $m$  is released from a height  $h$  above a smooth wedge of mass  $M$  kept on a rigid horizontal ground. Then the normal reaction from ground which is impulsive in nature imparts to the (ball + wedge) system
- (A) imparts some momentum as well as energy.  
 (B) imparts some energy but no momentum  
 (C) imparts some momentum but no energy  
 (D) imparts neither momentum nor energy.

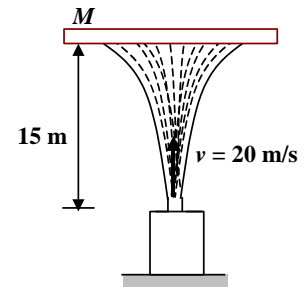


11. An adiabatic chamber has frictionless insulated piston of mass  $m$ . Mass of the remaining chamber including gas is  $4m$ . 'n' moles of an ideal monoatomic gas is present inside the chamber at atmospheric temperature and pressure. Piston is in rest at equilibrium and confined to move along the length of the cylinder. A particle of mass  $m$  moving horizontally with speed  $v$ , strikes elastically with the piston. The change in temperature of the gas when the compression of the gas is maximum is

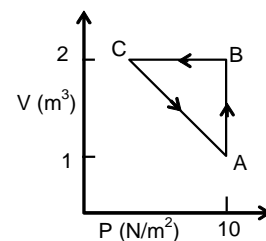


- (A)  $\frac{2mv^2}{9nR}$  (B)  $\frac{4mv^2}{15nR}$   
 (C)  $\frac{7mv^2}{15nR}$  (D)  $\frac{mv^2}{nR}$

12. A vertical jet of water coming out of a nozzle with velocity 20 m/s supports a plate of mass  $M$  stationary at a height  $h = 15\text{m}$ , as shown in the figure. If the rate of water flow is 1 litre per second, the mass of the plate is (Assume the collision to be *inelastic*).
- (A) 1 kg (B) 1.414 kg  
 (C) 2 kg (D) 10 kg



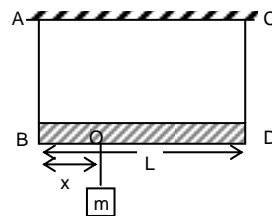
13. An ideal gas is taken through the cycle  $A \rightarrow B \rightarrow C \rightarrow A$ , as shown in the figure. If the net heat supplied to the gas in the cycle is 5J, the work done by the gas in the process  $C \rightarrow A$  is
- (A) -5J (B) -10J  
 (C) -15 (D) -20J



Space for rough work

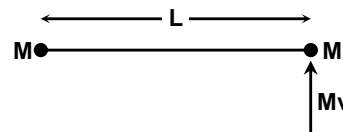
14. A massless rod is suspended by two identical strings AB and CD of equal length. A block of mass  $m$  is suspended from point O such that BO is equal to 'x'. Further, it is observed that the frequency of 1<sup>st</sup> harmonic (fundamental frequency) in AB is equal to 2<sup>nd</sup> harmonic frequency in CD. Then, length of BO is

(A)  $L/5$  (B)  $4L/5$   
(C)  $3L/4$  (D)  $L/4$



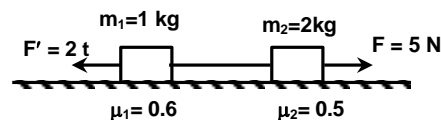
15. Two particles each of mass  $M$ , are connected by a rigid rod of negligible mass and length  $L$ . The system is lying on a horizontal frictionless surface. An impulse  $Mv$ , perpendicular to the rod, is given at one end of the rod as shown in the figure. The angular velocity acquired by the rod is

(A)  $4v/L$  (B)  $2v/L$   
(C)  $v/L$  (D)  $v/4L$



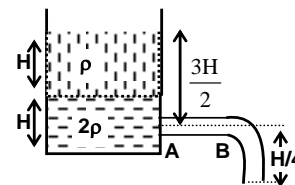
16. Two blocks A and B are separated by some distance and tied by a string as shown in the figure. The force of friction in both the blocks at  $t = 2$  sec is

(A)  $4\text{ N} (\rightarrow), 5\text{ N} (\leftarrow)$  (B)  $2\text{ N} (\rightarrow), 5\text{ N} (\leftarrow)$   
(C)  $0\text{ N} (\rightarrow), 10\text{ N} (\leftarrow)$  (D)  $1\text{ N} (\rightarrow), 5\text{ N} (\leftarrow)$



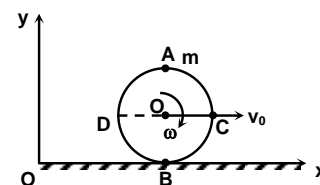
17. Water flows out of a big tank along a horizontal tube AB of length  $L$  and radius  $R$  and bends at right angle at the other end as shown in the figure. Find moment of force exerted by water on the tube about the end A. (Assume that the radius of the tube is small.)

(A)  $5\rho\pi R^2 gHL$  (B)  $10\rho\pi R^2 gHL$   
(C)  $15\rho\pi R^2 gHL$  (D) none of the above



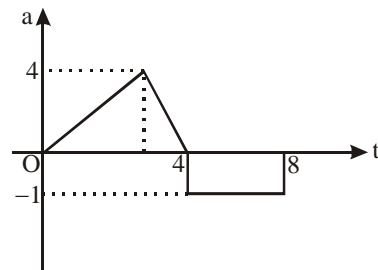
18. A particle of mass 'm' is attached to the rim of a uniform disc of mass 'm' and radius  $R$ . The disc is rolling without slipping on a stationary horizontal surface, as shown in the figure. At a particular instant, the particle is at the top most position and centre of the disc has speed  $v_0$  and its angular speed is  $\omega$ . Choose the incorrect regarding the motion of the system (disc + particle) at that instant.

(A)  $v_0 = \omega R$  (B) kinetic energy of the system is  $\frac{11}{4}mv_0^2$   
(C) speed of point mass  $m$  is less than  $2v_0$  (D)  $|\vec{v}_C - \vec{v}_B| = |\vec{v}_B - \vec{v}_D|$



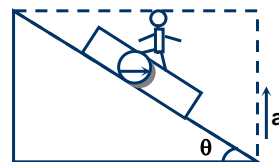
**Space for rough work**

19. The acceleration time graph of a particle is shown in the figure. What is the velocity of particle at  $t = 8\text{s}$ , if initial velocity of particle is  $3\text{ m/s}$ ?
- (A)  $4\text{ m/s}$   
 (B)  $5\text{ m/s}$   
 (C)  $6\text{ m/s}$   
 (D)  $7\text{ m/s}$

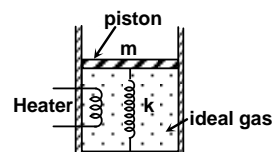


20. In a gaseous medium two waves of wavelengths  $1\text{ m}$  and  $1.01\text{ m}$  produce 20 beats in 6 sec. The velocity of the sound in the gas will be (approximately)
- (A)  $320\text{ m/s}$  (B)  $300\text{ m/s}$   
 (C)  $337\text{ m/s}$  (D)  $350\text{ m/s}$
21. A monoatomic gas ( $\gamma = 5/3$ ) is suddenly compressed to  $(1/8)^{\text{th}}$  its volume adiabatically. The pressure of the gas will change to
- (A)  $24/5$  (B)  $8$   
 (C)  $40/3$  (D)  $32$
22. A metal bar clamped at its centre resonates in its fundamental mode to produce longitudinal waves of frequency  $4\text{ kHz}$ . Now, the clamp is moved to one end. If  $f_1$  and  $f_2$  are the frequencies of first overtone and second overtone, respectively, then
- (A)  $3f_2 = 5f_1$  (B)  $3f_1 = 5f_2$   
 (C)  $f_2 = 2f_1$  (D)  $2f_2 = f_1$

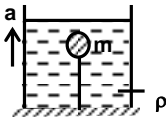
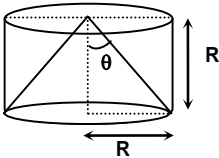
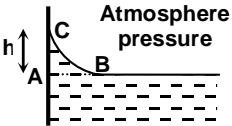
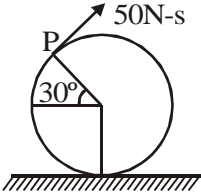
23. A man of mass  $m = 60\text{ kg}$  is standing on a weighing machine fixed on a triangular wedge of angle  $\theta = 60^\circ$  with horizontal as shown in the figure. The wedge is moving up with an upward acceleration  $a = 2\text{ m/s}^2$ . The weight registered by machine is
- (A)  $600\text{ N}$  (B)  $1440\text{ N}$   
 (C)  $360\text{ N}$  (D)  $240\text{ N}$



24. The gas inside a insulated container having movable non-conducting piston which is attached by a spring to the bottom (as shown in the figure) is slowly heated. The process is
- (A) isothermal (B) adiabatic  
 (C) isobaric (D) none of these



**Space for rough work**

25. A wooden ball of mass  $m$  (density  $\sigma$ ) is kept inside water (density  $\rho > \sigma$ ) by the help of a massless string shown in the figure. One end of the string is fixed at the bottom of vessel. When the vessel containing the water is accelerated upwards with acceleration  $a$  as shown in the figure.
- 
- (A) tension in the string will remain same (B) tension in the string will decrease  
(C) force of buoyancy will increase (D) force of buoyancy will decrease.
26. If a uniform solid sphere is rolling without sliding on a stationary surface, the ratio of its rotational kinetic energy to the total kinetic energy is given by
- (A) 7 : 10 (B) 2 : 5  
(C) 10 : 7 (D) 2 : 7
27. A vertical cylinder of radius  $R$  and height  $R$  has a right circular cone at its base of height  $R$  and base radius  $R$ . The liquid of density  $\rho$  is filled upto the brim. The force due to liquid on the curved surface of cone is (neglect the atmospheric pressure)
- 
- (A)  $\pi R^3 \rho g$  (B)  $\frac{2}{3} \pi R^3 \rho g$   
(C)  $\pi R^3 \rho g / 2$  (D) none of the above
28. A perfectly wetting liquid (angle of contact =  $0^\circ$ ) touches a wall and rises upto height  $h$ . Let  $\mu$  denotes the mass per unit length contained in cross section ABC. If  $T$  is the surface tension of liquid. Then,
- 
- (A)  $T > \mu g$  (B)  $T = \mu g$   
(C)  $T < \mu g$  (D) none of these
29. A solid ball of radius 0.2m and mass 1kg lying at rest on a smooth horizontal surface is given an instantaneous impulse of 50 N-s at point P and tangential to the ball as shown. The number of rotations made by the ball about its diameter before hitting the ground is
- 
- (A)  $\frac{625\sqrt{3}}{2\pi}$  (B)  $\frac{2500\sqrt{3}}{2\pi}$   
(C)  $\frac{3125\sqrt{3}}{2\pi}$  (D)  $\frac{1250\sqrt{3}}{2\pi}$
30. An organ pipe  $P_1$  closed at one end vibrating in its first harmonic and another pipe  $P_2$  open at both ends vibrating in its third harmonic are in resonance with a given tuning fork. The ratio of the length of  $P_1$  to that of  $P_2$  is
- (A)  $\frac{8}{3}$  (B)  $\frac{3}{8}$   
(C)  $\frac{1}{6}$  (D)  $\frac{1}{3}$

**Space for rough work**

**Chemistry****PART – B****(Single Correct Choice Type)**

This section contains **30 multiple choice questions**. Each question has four choice (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

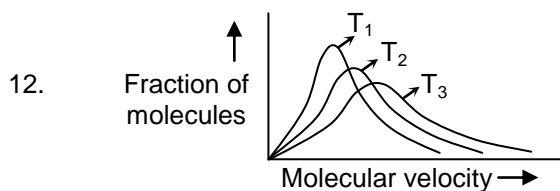
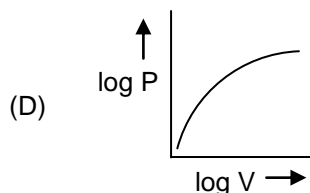
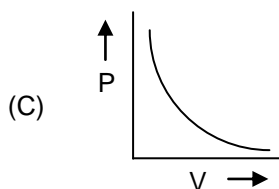
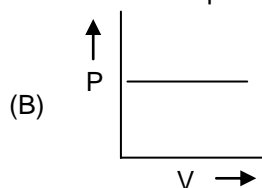
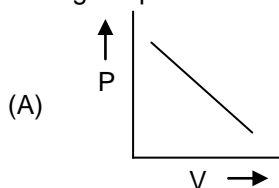
- Which of the following anion is not bigger than hydride ion ( $\text{H}^-$ )  
 (A)  $\text{F}^-$  (B)  $\text{Cl}^-$   
 (C)  $\text{Br}^-$  (D)  $\text{I}^-$
- H, D and  $\text{He}^+$  are all one electron species. The wavelengths of radiations emitted for their downward transitions from 1<sup>st</sup> excited state to ground state are  $\lambda_1$ ,  $\lambda_2$  and  $\lambda_3$  respectively. Then approximately:  
 (A)  $4\lambda_1 = 2\lambda_2 = 2\lambda_3$  (B)  $\lambda_1 = 2\lambda_2 = 2\sqrt{2}\lambda_3$   
 (C)  $\lambda_1 = \lambda_2 = 2\lambda_3$  (D)  $\lambda_1 = \lambda_2 = 4\lambda_3$
- In  $\text{IBr}_3\text{F}_2$ , the Br – I – F angle is:  
 (A)  $120^\circ$  (B)  $180^\circ$   
 (C)  $90^\circ$  (D)  $109^\circ 28'$
- Which of the following is a **wrong** order with respect to the property mentioned against each -  
 (A)  $(\text{NO})^- > (\text{NO}) > (\text{NO})^+$  [bond length]  
 (B)  $\text{H}_2 > \text{H}_2^+ > \text{He}_2^+$  [bond energy]  
 (C)  $\text{O}_2^{2-} > \text{O}_2 > \text{O}_2^{2+}$  [Paramagnetism]  
 (D)  $\text{NO}_2^+ > \text{NO}_2 > \text{NO}_2^-$  [bond angle]
- The given reaction  $2\text{SO}_3 \rightleftharpoons 2\text{SO}_2 + \text{O}_2$  starting with 2 mol of  $\text{SO}_3$  in 2l flask, the equilibrium mix required 0.8 mol of  $\text{MnO}_4^-$  in basic medium. Find the value of  $K_p$  for the formation of  $\text{SO}_3$  at  $27^\circ\text{C}$ .  
 (A) 6.76 atm (B)  $3.75 \text{ atm}^{-1}$   
 (C)  $6.76 \text{ atm}^{-1}$  (D) 3.75 atm
- In a reaction  $\text{A}(\text{s}) \rightleftharpoons 3\text{B}(\text{g}) + 3\text{C}(\text{g})$ . If the conc. Of B at equilibrium is increased by a factor of 3, it will cause the equilibrium concentration of C to change to  
 (A) 4 times the original value (B) 1/2 of its original value  
 (C) 1/3 of its original value (D) 3 times the original value

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**Space for rough work**



7. The solubility of  $\text{Cd}(\text{CN})_2$  in 0.05 M NaCN solution will be? The  $K_{\text{sp}}$  of  $\text{Cd}(\text{CN})_2$  is  $1.0 \times 10^{-8}$  m  
 (A)  $1 \times 10^{-8}$  (B)  $2 \times 10^{-6}$   
 (C)  $3 \times 10^{-8}$  (D)  $4 \times 10^{-6}$
8. In an adiabatic expansion of air (assume it a mixture of  $\text{N}_2$  and  $\text{O}_2$ ), the volume increases by 5% the percentage change in pressure is:  
 (A) 3% (B) 4%  
 (C) 6% (D) 7%
9. Calculate the entropy change at 373K for the following transformation.  
 $\text{H}_2\text{O}(\text{l}, 1.01325 \text{ bar}) \rightarrow \text{H}_2\text{O}(\text{g}, 0.101325 \text{ bar})$ . Given  $\Delta_{\text{vap}} H(\text{H}_2\text{O}) = 37.3 \text{ kJ mol}^{-1}$   
 (A)  $19.14 \text{ JK}^{-1} \text{ mol}^{-1}$  (B)  $119.14 \text{ JK}^{-1} \text{ mol}^{-1}$   
 (C)  $80.86 \text{ JK}^{-1} \text{ mol}^{-1}$  (D)  $180.86 \text{ JK}^{-1} \text{ mol}^{-1}$
10. A 4 g mixture of  $\text{Na}_2\text{O}$  and NaCl was dissolved in 400 mL of 0.3 M HCl. After complete reaction, the resulting solution required 200 mL of 0.2 M NaOH for complete neutralization of the excess HCl. What mass % of  $\text{Na}_2\text{O}$  is present in the mixture?  
 (A) 18% (B) 82%  
 (C) 62% (D) 38%
11. Among the plots of P versus V, as given below, which one corresponds to Boyle's law ?

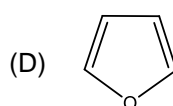
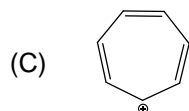
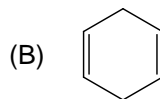
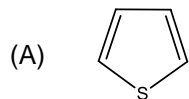


Above graph is plotted for  $\text{CO}_2$  at three different temperature, i.e., 273K, 1273K and 2773k. Which of the following option is correct about these temperatures?

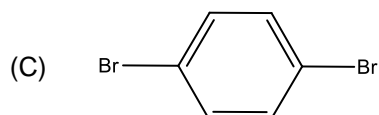
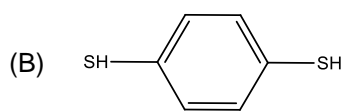
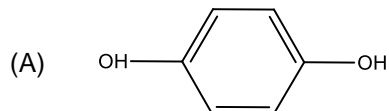
- |     | $T_1$  | $T_2$  | $T_3$  |
|-----|--------|--------|--------|
| (A) | 273 K  | 1273 K | 2773 K |
| (B) | 2773 K | 1273 K | 273 K  |
| (C) | 1273 K | 2773 K | 273 K  |
| (D) | 2773 K | 273 K  | 1273 K |

**Space for rough work**

13. Which of the following is not an aromatic compound ?

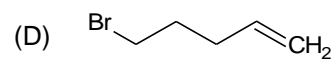
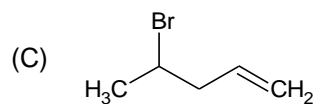
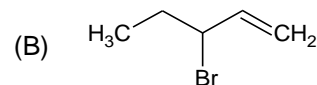
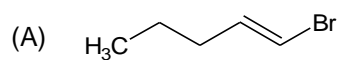
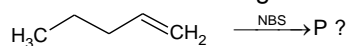


14. Dipole moment of which compound will be zero?



(D) All of these

15. Which of the following will be the correct product (P) of the reaction



16. An unknown compound **A** has a molecular formula  $\text{C}_4\text{H}_6$ . When **A** is treated with excess of  $\text{Br}_2$ , a new substance **B** of molecular formula  $\text{C}_4\text{H}_6\text{Br}_4$  is formed. **A** forms a white ppt. with ammonical silver nitrate solution. **A** may be –

(A) But-1-yne

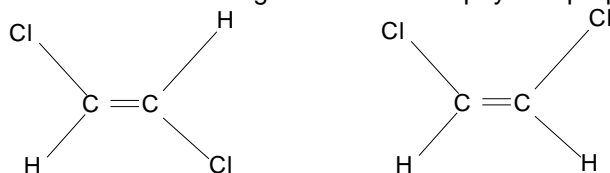
(B) But-2-yne

(C) Buta-1,3-diene

(D) Buta-1,2-diene

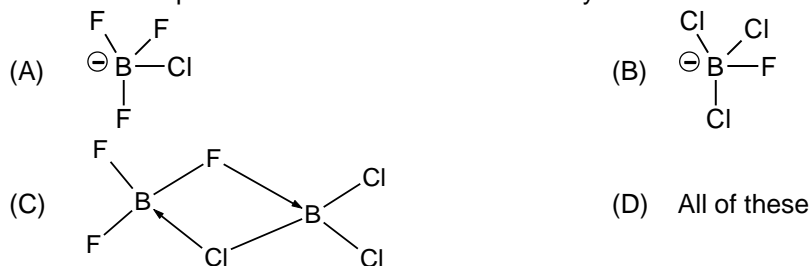
**Space for rough work**

17. Which of the following is correct set of physical properties of the geometrical isomers :



	I	II		
	Dipole moment	Boiling point	Melting point	Stability
(A)	I > II	I > II	II > I	I > II
(B)	II > I	II > I	II > I	II > I
(C)	I > II	I > II	I > II	I > II
(D)	II > I	II > I	I > II	I > II

18. When  $\text{BF}_3$  and  $\text{BCl}_3$  are mixed together, it produces  $\text{BF}_2\text{Cl}$  and  $\text{BFCl}_2$  through halogen exchange. The intermediate species involved in this reaction may be:



19. Which of the following is the correct order of the magnitude of  $-\text{I}$  effect among the groups given :

- (A)  $-\text{F} > -\text{NO}_2 > -\text{COOH} > -\text{OCH}_3$       (B)  $-\text{NO}_2 > -\text{F} > -\text{COOH} > -\text{OCH}_3$   
 (C)  $-\text{NO}_2 > -\text{COOH} > -\text{F} > -\text{OCH}_3$       (D)  $-\text{COOH} > -\text{NO}_2 > -\text{OCH}_3 > -\text{F}$

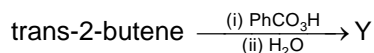
20. Alkaline solution of  $\text{NaNO}_2$  on heating with Zn powder produces a gas. The gas is

- (A) Colorless and acidic      (B) Colorless and neutral  
 (C) Light fumes and acidic      (D) Colorless and basic

21. Mark the correct statement

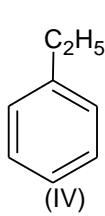
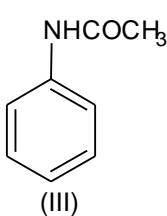
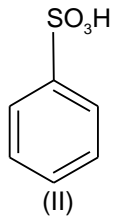
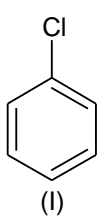
- (A)  $\text{H}_3\text{O}^+$  as such is electrophile as well as nucleophile  
 (B)  $\text{H}_3\text{O}^+$  as such as electrophile but not nucleophile  
 (C)  $\text{H}_3\text{O}^+$  as such is the neither electrophile nor nucleophile  
 (D)  $\text{H}_3\text{O}^+$  as such is nucleophile but not electrophile

**Space for rough work**



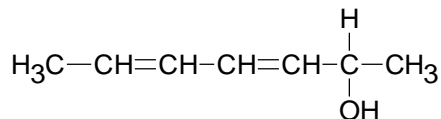
The correct statements about X and Y are:

- (A) X is optically inactive whereas Y is active      (B) X is optically active whereas Y is inactive  
 (C) Both X and Y are optically inactive              (D) Both X and Y are optically active
23. In aqueous solution which will act as strongest base among the following  
 (A)  $\text{CH}_3\text{NH}_2$     (B)  $(\text{CH}_3)_2\text{NH}$   
 (C)  $(\text{CH}_3)_3\text{N}$     (D)  $\text{CH}_3\text{CH}_2\text{NH}_2$
24. What is the expected order of reactivity of the following compounds in electrophilic nitration (more reactive, less reactive)?

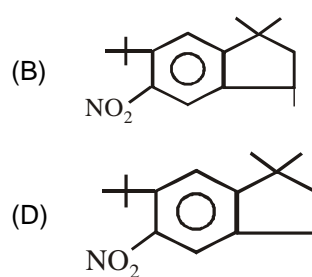
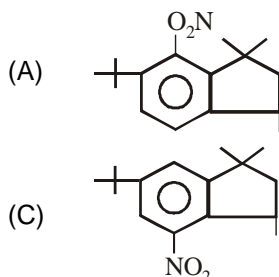
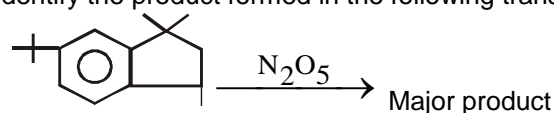


- (A) I > II > III > IV                                      (B) IV > I > II > III  
 (C) III > IV > I > II                                      (D) II > I > IV > III

25. Number of stereoisomers of following compound is

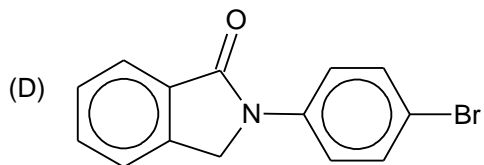
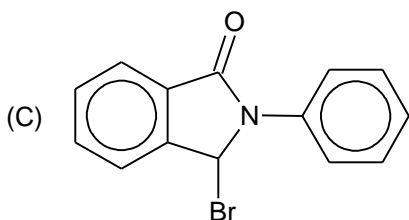
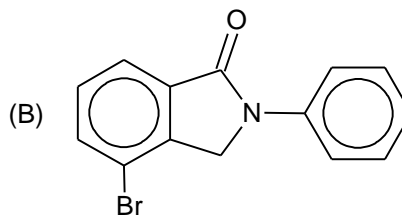
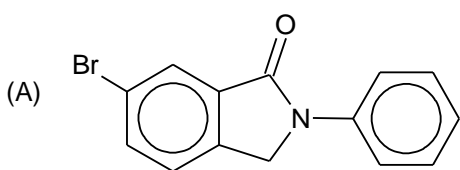
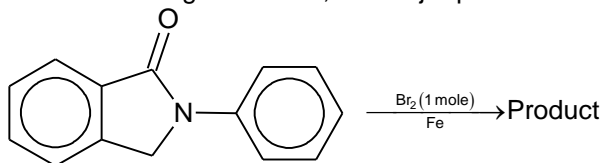


- (A) 2    (B) 4  
 (C) 6    (D) 8
26. In which case bond length of C - O bond is maximum  
 (A) Carboxylate ion                                      (B) Phenoxide ion  
 (C) p-nitro phenoxide ion                              (D) 2, 4 di nitro phenoxide ion
27. Identify the product formed in the following transformation



**Space for rough work**

28. Which statement is true about mono nitration of toluene ?  
(A) Activation energies for the formation of o,m & p nitro toluene are same.  
(B) Activation energy for the formation of m-nitro toluene is greater than that of o & p nitro toluene.  
(C) Activation energies for the formation of o & p nitro toluene are different.  
(D) Activation energy of o & p nitro derivatives is greater than that of meta nitro derivative.
29. Among the following the correct statement concerning the optical activity is :  
(A) a molecule containing two or more chiral centres is always optically active  
(B) a molecule containing just one chiral centre is always optically active  
(C) a molecule possessing alternating axis of symmetry is optically active  
(D) an optically active molecule should have at least one chiral centre
30. In the reaction given below, the major product formed is:



**Space for rough work**

**Mathematics****PART – C****(Single Correct Choice Type)**

This section contains **30 multiple choice questions**. Each question has four choice (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

- If the straight lines  $ax + by + p = 0$  and  $x \cos\alpha + y \sin\alpha = p$  are inclined at an angle  $\frac{\pi}{4}$  and concurrent with the straight line  $x \sin\alpha - y \cos\alpha = 0$ , then the value of  $a^2 + b^2$  is  
 (A) 0 (B) 1  
 (C) 2 (D) none of these
- If  $x_1, x_2, x_3$  as well as  $y_1, y_2, y_3$  are in G.P with the same common ratio, then the points  $(x_1, y_1), (x_2, y_2)$  and  $(x_3, y_3)$   
 (A) lie on a straight line (B) lie on a circle  
 (C) vertices of a triangle (D) none of these
- $\int e^{\sqrt{x}} dx$  is  
 (A)  $2\left[\sqrt{x}e^{\sqrt{x}} - e^{-x}\right] + c$  (B)  $\sqrt{xe^{\sqrt{x}}} - e^{-x} + c$   
 (C)  $2\left[\sqrt{x}e^{\sqrt{x}} - e^{\sqrt{x}}\right] + c$  (D)  $2\left[xe^{\sqrt{x}} - e^{-x}\right] + c$
- For any real  $\theta$ , the maximum value of  $\cos^2(\cos\theta) + \sin^2(\sin\theta)$   
 (A) is 1 (B) is  $1 + \sin^2 1$   
 (C) is  $1 + \cos^2 1$  (D) does not exist
- The value of  $\left(\tan\left(\frac{\pi}{4} + \frac{1}{2}\sin^{-1}\left(\frac{a}{b}\right)\right) + \tan\left(\frac{\pi}{4} - \frac{1}{2}\sin^{-1}\left(\frac{a}{b}\right)\right)\right)^{-1}$ , where  $0 < a < b$  is  
 (A)  $\frac{b}{2a}$  (B)  $\frac{a}{2b}$   
 (C)  $\frac{\sqrt{b^2 - a^2}}{2b}$  (D)  $\frac{\sqrt{b^2 - a^2}}{2a}$

**Space for rough work**

6. The set of values of  $x$  for which the inequality  $\sin^4\left(\frac{x}{3}\right) + \cos^4\left(\frac{x}{3}\right) > \frac{1}{2}$  holds, is
- (A)  $\mathbb{R}$  (B)  $\left\{x \mid x = \frac{3n\pi}{2} \pm \frac{3\pi}{4}; n \in \mathbb{I}\right\}$
- (C)  $\mathbb{R} - \left\{x \mid x = \frac{3n\pi}{2} \pm \frac{3\pi}{4}; n \in \mathbb{I}\right\}$  (D)  $\phi$
7. If tangents are drawn from a point  $P(-3, 4)$  to the circle  $x^2 + y^2 = 4$ , touching at  $Q$  and  $R$ , then the equation of the circumcircle to the triangle  $PQR$  is
- (A)  $x^2 + y^2 + 4x - 3y = 0$  (B)  $x^2 + y^2 - 3x + 4y = 0$
- (C)  $x^2 + y^2 + 3x - 4y = 0$  (D) none of these
8. The equation of the image of the circle  $x^2 + y^2 + 16x - 24y + 183 = 0$  by the line mirror  $4x + 7y + 13 = 0$  is
- (A)  $x^2 + y^2 + 32x - 4y + 235 = 0$  (B)  $x^2 + y^2 + 32x + 4y - 235 = 0$
- (C)  $x^2 + y^2 + 32x - 4y - 235 = 0$  (D)  $x^2 + y^2 + 32x + 4y + 235 = 0$
9. The locus of the centre of the circle described on any focal chord of a parabola  $y^2 = 4ax$  as diameter is
- (A)  $x^2 = 2a(y - a)$  (B)  $x^2 = -2a(y - a)$
- (C)  $y^2 = 2a(x - a)$  (D)  $y^2 = -2a(x - a)$
10. If the  $y - \sqrt{3}x + 3 = 0$  line cuts the parabola  $y^2 = x + 2$  at  $A$  and  $B$ , and if  $P \equiv (\sqrt{3}, 0)$ , then  $PA \cdot PB$  is equal to
- (A)  $\frac{2(\sqrt{3} + 2)}{3}$  (B)  $\frac{4\sqrt{3}}{2}$
- (C)  $\frac{4(2 - \sqrt{3})}{3}$  (D)  $\frac{4(2 + \sqrt{3})}{3}$
11. If  $\alpha$  and  $\beta$  are eccentric angles of the ends of a focal chord of the ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ , then  $\tan \frac{\alpha}{2} \tan \frac{\beta}{2}$  is equal to
- (A)  $\frac{1 - e}{1 + e}$  (B)  $\frac{e - 1}{e + 1}$
- (C)  $\frac{e + 1}{e - 1}$  (D)  $\frac{e + 1}{1 - e}$

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**Space for rough work**

12. If a variable straight line  $x\cos\alpha + y\sin\alpha = p$  which is a chord of the hyperbola  $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$  ( $b > a$ ) subtend a right angle at the centre of the hyperbola then it always touches a fixed circle having centre at origin whose radius is
- (A)  $\frac{a}{\sqrt{b^2 - a^2}}$  (B)  $\frac{b}{\sqrt{b^2 - a^2}}$   
 (C)  $\frac{ab}{\sqrt{b^2 - a^2}}$  (D) none of these
13. Let  $\alpha, \beta \in \mathbb{R}$  be the roots of the equation  $ax^2 + bx + c = 0$ , then  $k \in \mathbb{R}$  lies between  $\alpha$  and  $\beta$  if
- (A)  $ak^2 + bk + c < 0$  (B)  $a^2k^2 + bak + ac < 0$   
 (C)  $a^2k^2 + ba^2k + a^2c < 0$  (D)  $ak^2 + bk + c > 0$
14. If  $a + b + c = 0$  and  $a, b, c$  are rational, then the roots of the equation  $(b+c-a)x^2 + (c+a-b)x + (a+b-c) = 0$  are
- (A) rational (B) irrational  
 (C) imaginary (D) equal
15. Suppose  $a, b, c$  are in A.P. and  $a^2, b^2, c^2$  are in G.P.. If  $a < b < c$  and  $a + b + c = \frac{3}{2}$ , then value of  $a$  is
- (A)  $\frac{1}{2\sqrt{2}}$  (B)  $\frac{1}{2\sqrt{3}}$   
 (C)  $\frac{1}{2} - \frac{1}{\sqrt{3}}$  (D)  $\frac{1}{2} - \frac{1}{\sqrt{2}}$
16. The sum of the factors of  $7!$ , which are odd and are of the form  $3t + 1$  where  $t$  is a whole number, is
- (A) 10 (B) 8  
 (C) 9 (D) 15
17. From a class of 25 students 10 are to be chosen for an excursion party. There are 3 particular students who decide that either all of them or none of them will join. The number ways they can be chosen is
- (A)  ${}^{22}C_7 + {}^{22}C_{10}$  (B)  ${}^{22}C_6 + {}^{22}C_{10}$   
 (C)  ${}^{22}C_7 + {}^{22}C_8$  (D) none of these
18. The number of terms free from radical sign in the expansion of  $(1 + 3^{1/3} + 7^{1/7})^{10}$  is
- (A) 1 (B) 6  
 (C) 11 (D) none of these

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**Space for rough work**



19. The value of  $2C_0 + 2^2 \frac{C_1}{2} + 2^3 \frac{C_2}{3} + \dots + 2^{n+1} \frac{C_n}{n+1}$  is
- (A)  $\frac{1}{2(n+1)}$  (B) 0  
 (C)  $\frac{2^{n+1} - 1}{2^{n+1}}$  (D)  $\frac{3^{n+1} - 1}{n+1}$
20. If  $|z| = 1$  then  $\frac{1+z}{1+\bar{z}}$  is equal to
- (A)  $z$  (B)  $\bar{z}$   
 (C)  $z + \bar{z}$  (D) none of these
21. If  $z_1, z_2, z_3$  are affixes of the vertices A, B and C respectively of a triangle ABC having centroid at G such that  $z = 0$  is the mid point of AG, then
- (A)  $z_1 + z_2 + z_3 = 0$  (B)  $z_1 + 4z_2 + z_3 = 0$   
 (C)  $z_1 + z_2 + 4z_3 = 0$  (D)  $4z_1 + z_2 + z_3 = 0$
22. The area of the circle and the area of a regular polygon of  $n$  sides, with their perimeters being equal, are in the ratio
- (A)  $\tan\left(\frac{\pi}{n}\right) : \frac{\pi}{n}$  (B)  $\cos\left(\frac{\pi}{n}\right) : \frac{\pi}{n}$   
 (C)  $\sin\left(\frac{\pi}{n}\right) : \frac{\pi}{n}$  (D)  $\cot\left(\frac{\pi}{n}\right) : \frac{\pi}{n}$
23. In a triangle ABC, if  $\left(1 + \frac{a}{b} + \frac{c}{b}\right)\left(1 + \frac{b}{c} - \frac{a}{c}\right) = 3$ , then the angle A is equal to
- (A)  $\frac{\pi}{3}$  (B)  $\frac{\pi}{4}$   
 (C)  $\frac{\pi}{6}$  (D) none of these
24. If  $\sin^{-1} 6x + \sin^{-1} 6\sqrt{3}x = -\frac{\pi}{2}$ , then  $x$  is equal to
- (A)  $-1$  (B)  $\frac{1}{\sqrt{12}}$   
 (C)  $-\frac{1}{12}$  (D) none of these

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**Space for rough work**

25. The number of solutions of the equation  $\sin^3 x \cos x + \sin^2 x \cos^2 x + \sin x \cos^3 x = 1$  in the interval  $[0, 2\pi]$  is  
 (A) 0 (B) 2  
 (C) 3 (D) infinite
26. The height of the chimney when it is found that on walking towards it 50 meters in the horizontal line through its base, the angle of elevation of its top changes from  $30^\circ$  to  $60^\circ$ , is  
 (A) 25 meter (B)  $25\sqrt{3}$  meter  
 (C) 50 meter (D) none of these
27. The value of  $\sum_{r=1}^n r(1-a)(1-2a)(1-3a)\dots\{1-(r-1)a\}$  is  
 (A)  $1 - (1-a)(1-2a)(1-3a)\dots(1-na)$   
 (B)  $a[1 - (1-a)(1-2a)\dots(1-na)]$   
 (C)  $\frac{1}{a}[1 - (1-a)(1-2a)\dots(1-na)]$   
 (D)  $\frac{1}{a}[1 - (1-a)(1-2a)(1-3a)\dots(1-(n-a)a)]$
28. Let P be a variable point on the ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  with foci  $F_1$  and  $F_2$ . If A is the max. area of the triangle  $PF_1F_2$  is equal to one fourth the area of the ellipse. Then eccentricity of the ellipse is  
 (A)  $\pi$  (B)  $\frac{\pi}{2}$   
 (C)  $\frac{\pi}{3}$  (D)  $\frac{\pi}{4}$
29. The sum of squares of deviations for 10 observations taken from mean 50 is 250. The coefficient of variation is  
 (A) 10% (B) 40%  
 (C) 50% (D) none of these
30.  $\sim(p \vee q) \vee (\sim p \wedge q)$  is logically equivalent to  
 (A)  $\sim p$  (B) p  
 (C) q (D)  $\sim q$

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**Space for rough work**

# MAINS (SET- A)

Physics			Chemistry			Mathematics		
Que.	Answers	Concept code	Que.	Answers	Concept code	Que.	Answers	Concept code
1	C	P110402	1	A	C111003	1	C	M110720
2	B	P111105	2	D	C110103	2	A	M110711
3	D	P110705	3	C	C110306	3	C	M120703
4	B	P111004	4	C	C110307	4	B	M111313
5	D	P111006	5	C	C110402	5	C	M121408
6	B	P110409	6	C	C110402	6	C	M111421
7	C	P111105	7	D	C110503	7	C	M110816
8	C	P111213	8	D	C111901	8	D	Image of Circle
9	A	P110505	9	B	C111906	9	C	M110910
10	C	P110605	10	A	C111104	10	D	M110715
11	B	P111209	11	C	C111201	11	B	M111025
12	A	P111010	12	C	C111206	12	C	Homogenization
13	A	P111213	13	A	C111801	13	B	M110105
14	A	P111303	14	B	C110304	14	A	M110101
15	C	P110723	15	C	C111709	15	D	M110503
16	A	P110410	16	B	C111712	16	B	M111214
17	A	P111010	17	A	C111706	17	A	M111211
18	C	P110812	18	D	C111508	18	B	M110414
19	D	P110325	19	C	C111301	19	D	M110411
20	C	P111311	20	C	C110809	20	A	M110302
21	D	P111211	21	C	C111301	21	D	M110401
22	A	P111310	22	C	C111707	22	A	M111520
23	C	P110413	23	B	C111302	23	A	M111502
24	D	P111209	24	C	C111804	24	C	M121408
25	C	P111007	25	D	C111403/ C111404	25	A	M111307
26	D	P110814	26	B	C110308	26	B	M111311
27	B	P111014	27	C	C111804	27	C	M110509
28	A	P111013	28	B	C111804	28	D	M111013
29	C	P110801	29	B	C111404	29	A	Statistics
30	C	P111309	30	D	C111804	30	A	Mathematical Reasoning