

# JEE MAIN

COURSE
NUCLEUS

TEST CODE				
1	1	2	6	9

## MOCK TEST-4

Class: XII

Date: 26-11-2018

Time: 3 Hours.

Max. Marks: 360

### IMPORTANT INSTRUCTIONS

1. The question paper consists of '90' objective type questions. There are '30' questions each in Chemistry, Physics and Mathematics respectively. Please fill the OMR answer Sheet accordingly and carefully.
2. Each question has four choices (1), (2), (3) and (4) out of which **ONLY ONE** is correct.
3. You will be **awarded 4 marks** for each question, if you have darkened only the bubble corresponding to the correct answer and zero mark if no bubble are darkened. In all other cases, **minus one (-1) mark** will be awarded.
4. There is only one correct response for each question. Filling up more than one response in each question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instruction 3 above.
5. Use **Black or Blue Ball Point Pen** only for filling particulars.
6. Use of **Calculator, Log Table, Slide Rule and Mobile** is not allowed.
7. Rough work is to be done on the space provided at the bottom and in end of the booklet for this purpose in the Test Booklet only.
8. On completion of the test, the candidate must hand over the Answer Sheet to the Invigilator. However, the candidates are allowed to take away this Test Booklet with them.
9. Do not fold or make any stray marks on the Answer Sheet.



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### USEFUL DATA

Atomic weights: Al = 27, Mg = 24, Cu = 63.5, Mn = 55, Cl = 35.5, O = 16, H = 1, P = 31, Ag = 108, N = 14, Li = 7, I = 127, Cr = 52, K = 39, S = 32, Na = 23, C = 12, Br = 80, Fe = 56, Ca = 40, Zn = 65.5, Ti = 48, Ba = 137, U = 238, Co = 59, B = 11, F = 19, He = 4, Ne = 20, Ar = 40, Mo = 96

[Take :  $\ln 2 = 0.693$ ,  $\ln 1.1 = 0.095$ ,  $\ln 3 = 1.09$ ,  $e = 1.6 \times 10^{-19}$ ,  $m_e = 9.1 \times 10^{-31}$  kg]

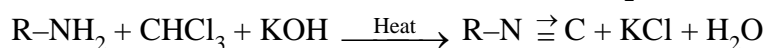
Take:  $\epsilon_0 = 8.85 \times 10^{-12}$  C<sup>2</sup>/Nm<sup>2</sup>,  $g = 10$  m/s<sup>2</sup>,  $S_{\text{water}} = 1$  cal/gm °C,  $L_{\text{ice}} = 80$  cal/gm.,  $g = 10$  m/s<sup>2</sup> unless otherwise stated

## CHEMISTRY

Q.1 During the process of electrolytic refining of Copper which of the following may obtained as a anode mud ?

- (1) Ag, Au                      (2) Ag, Zn                      (3) Fe, Ni                      (4) Zn, Ni

Q.2 How many moles of KOH are required per mole of R-NH<sub>2</sub> in the balanced reaction ?



- (1) 1                                  (2) 2                                  (3) 3                                  (4) 4

Q.3 An ionic solid 'AB' ( $M_w = 120$  g/mol) has NaCl type structure. The shortest distance between cation and anion is 500 pm. If there is a schottky defect of 2% then the density of crystal in g/cm<sup>3</sup> will be :

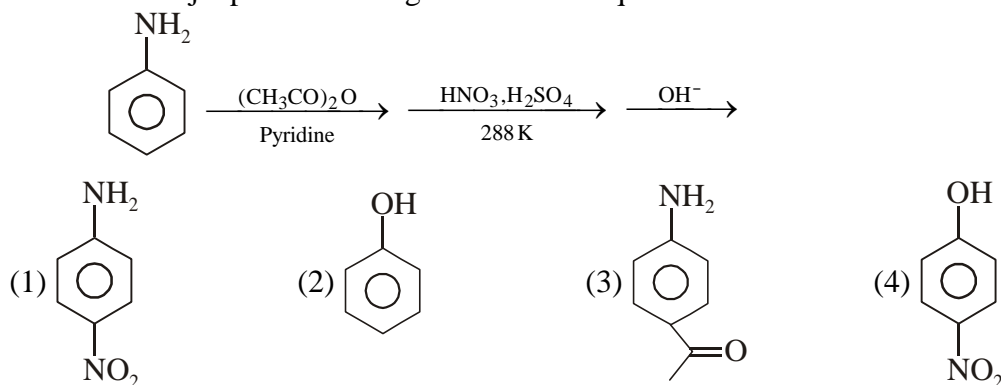
( $N_A = 6 \times 10^{23}$ )

- (1) 0.80                              (2) 0.784                              (3) 0.016                              (4) None of these

Q.4 Which of the following metal is not commercially extracted by self reduction method from their corresponding ore ?

- (1) Cu                                  (2) Fe                                  (3) Pb                                  (4) Hg

Q.5 What is the major product of the given reaction sequence ?



SPACE FOR ROUGH WORK

Q.6 At 27°C, the vapour pressure of an aqueous solution of urea is equal to the osmotic pressure of  $5 \times 10^{-3}$  M aqueous solution of glucose. If vapour pressure of pure water at 27°C is 114 torr then the mole fraction of urea in its solution is - [Given :  $R = 0.08$  L-atm/mol-K]

- (1)  $\frac{4}{5}$                       (2) 0.25                      (3)  $\frac{3}{4}$                       (4) 0.2

Q.7 Select incorrect statement regarding silver extraction -

- (1) Cupellation process is used when Lead - Silver alloy is rich in Silver and Lead is removed.  
(2) Parke's and Pattinson's process is used when Lead Silver alloy is rich in lead.  
(3) Zinc forms alloy with Lead, from which Lead is separated by distillation.  
(4) Zinc forms alloy with Silver, from which Zinc is separated by distillation.

Q.8 What is the colour of the dye formed in the given reaction ?



- (1) Red                      (2) Orange                      (3) Blue                      (4) Yellow

Q.9 In a solid compound, X-particles are present in ccp position, Y-particle are in all octahedral voids and Z-particles are in alternate tetrahedral voids. If all void- particles along one of the body-diagonal are removed then the formula of compound will be given as -

- (1)  $X_4Y_3Z_3$                       (2)  $X_3Y_4Z_3$                       (3)  $X_4Y_4Z_3$                       (4)  $X_4Y_3Z_4$

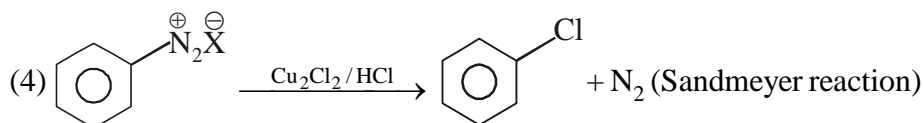
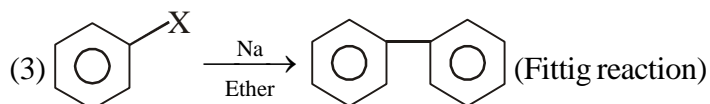
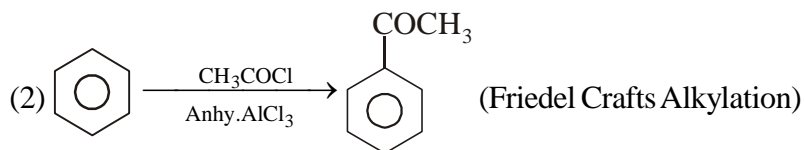
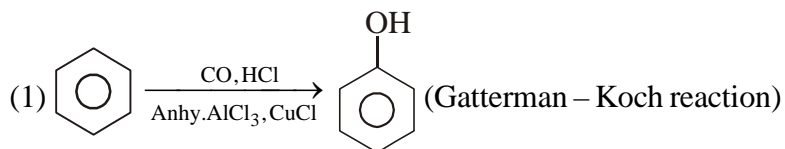
Q.10 During the extraction process of Copper, Silica is added to roasted ore, in order to remove.

- (1) cuprous sulphide    (2) ferrous oxide                      (3) ferrous sulphide    (4) cuprous oxide

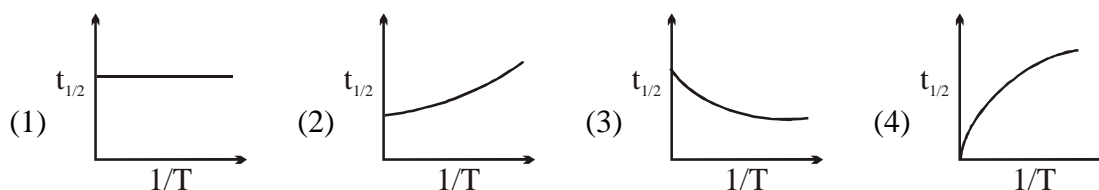
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SPACE FOR ROUGH WORK

Q.11 Find the incorrect combination of reaction and reaction name.



Q.12 For a 1<sup>st</sup> order reaction, the correct graph showing variation of half-life ( $t_{1/2}$ ) with inverse of Kelvin-temperature ( $1/T$ ) will be -



Q.13 During Froath Flootation process, use of depressant is :

- (1) to remove gangue from the sulphide ore.      (2) to separate two sulphide ore selectively.  
 (3) as froath stabilizer.                                      (4) to wet gangue particles.

Q.14 Which sugar is composed only of  $\beta$ -D-glucose units ?

- (1) Starch                      (2) Cellulose                      (3) Lactose                      (4) Sucrose

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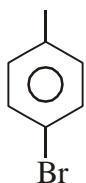
SPACE FOR ROUGH WORK

- Q.15 Due to non-stoichiometric defect, a sample of cuprous oxide is found to have a composition  $\text{Cu}_{1.8}\text{O}$ . The mole % of  $\text{Cu}^{2+}$  in total copper content of the crystal will be -  
 (1) 10% (2) 11.11 % (3) 88.88 % (4) 90 %
- Q.16 A salt impart red colour to the borax bead in reducing flame, what could be the colour of the bead in oxidising flame.  
 (1) Blue (2) Green (3) Yellow (4) Violet
- Q.17 Which of the following is a condensation copolymer ?  
 (1) Styrene (2) Buna-S (3) Bakelite (4) Nylon-6
- Q.18 The abnormal molecular mass of  $\text{CH}_3\text{COOH}$  when dissolved in benzene is found to be 80 g/mol. The percentage of  $\text{CH}_3\text{COOH}$  present in dimeric form in solution is -  
 (1) 50% (2) 12.75 % (3) 25 % (4) 33.33 %
- Q.19 Which of the following pair of cations can be separated by using excess  $\text{NH}_3$  solution ?  
 (1)  $\text{Bi}^{3+}(\text{aq})$  and  $\text{Al}^{3+}(\text{aq})$  (2)  $\text{Al}^{3+}(\text{aq})$  and  $\text{Zn}^{2+}(\text{aq})$   
 (3)  $\text{Hg}^{2+}(\text{aq})$  and  $\text{Pb}^{2+}(\text{aq})$  (4)  $\text{Cu}^{2+}(\text{aq})$  and  $\text{Cd}^{2+}(\text{aq})$
- Q.20 Select the cationic detergent amongst the following.  
 (1) Sodium Palmitate (2) Sodium Stearate  
 (3) Cetyl trimethyl ammonium bromide (4) Sodium Lauryl sulphate
- Q.21 A solution is prepared by mixing two volatile liquids. If its vapour pressure is lesser as compared to the vapour pressure calculated from Raoult's law then the only incorrect option for the solution is -  
 (1)  $\Delta H_{\text{mix}} > 0$  (2)  $\Delta V_{\text{mix}} < 0$  (3)  $\Delta S_{\text{mix}} > 0$  (4)  $\Delta G_{\text{mix}} < 0$
- Q.22 Filtrate obtained from group II basic radicals is heated with drops of dil.  $\text{HNO}_3$  before adding reagent of group III, in order to -  
 (1) to remove  $\text{HCl}$  and  $\text{H}_2\text{S}$  (2) to convert  $\text{Fe}^{2+}$  into  $\text{Fe}^{3+}$   
 (3) to oxidise  $\text{Cr}^{3+}$  to  $\text{Cr}_2\text{O}_7^{2-}$  (4) to lower the pH of solution.

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SPACE FOR ROUGH WORK

Q.23 Indicate the IUPAC name of the following compound.



- (1) 3-bromo-1-methyl benzene                      (2) 4-bromo toluene  
(3) p-ethyl bromo benzene                      (4) 1-methyl-4-bromo benzene

Q.24 Specific activity of a radioactive substance ( $M = 226$  amu) is  $3.7 \times 10^{10}$  disintegration per second per gram. The mean life of substance (years) is nearly  $-\lambda^{-1}$  [ $N_A = 6 \times 10^{23}$ ]

- (1) 2270                      (2) 2822                      (3) 8228                      (4) 8822

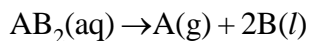
Q.25  $H_2S$  gas when passed through a solution containing cations in presence of  $HCl$ , it precipitates the cations of second group of qualitative analysis but not those belongs to the fourth group. It is because :

- (1) Presence of  $HCl$  decreases the sulphide ion concentration.  
(2) Presence of  $HCl$  increases the sulphide ion concentration.  
(3)  $K_{sp}$  of group II sulphides is more than that of group IV sulphides.  
(4) Sulphides of group IV cations are unstable in  $HCl$ .

Q.26 Which compound gives a base insoluble product with benzene sulphonyl chloride?

- (1) N-ethyl aniline                      (2) p-toluidine  
(3) Anisole                      (4) Trimethyl amine

Q.27  $AB_2$  (aqueous) decomposes according to the first order reaction :



After 20 min the volume of  $A(g)$  collected during such a reaction is 20 ml and that collected after a very long time is 40 ml at same temperature and pressure. The rate constant for the reaction is:

- (1)  $1.435 \times 10^{-2} \text{ min}^{-1}$                       (2)  $2.5 \times 10^{-2} \text{ min}^{-1}$   
(3)  $3.46 \times 10^{-2} \text{ min}^{-1}$                       (4)  $6.93 \text{ min}^{-1}$

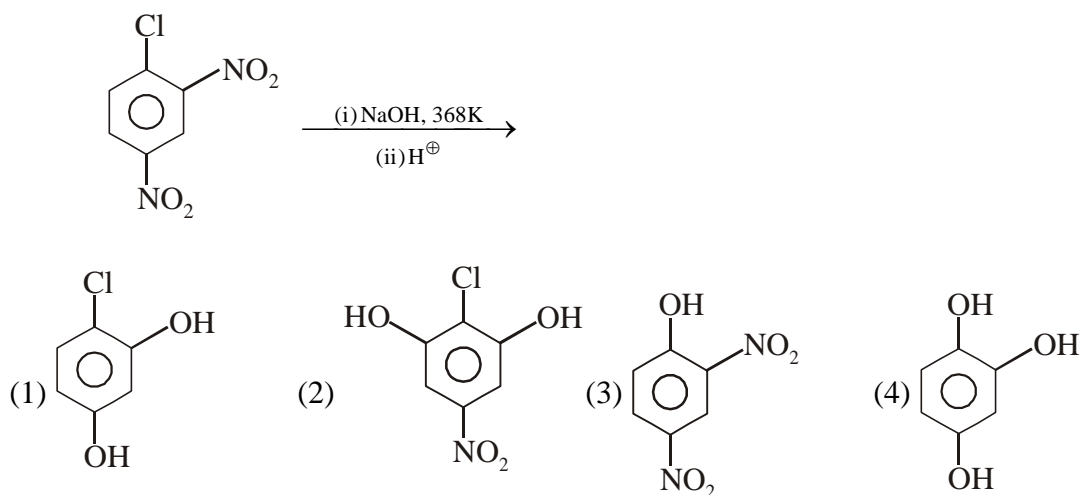
Q.28 On adding  $KI$  solution in excess to a solution of  $CuSO_4$ . We get precipitates 'P' and other liquid solution 'M'. Select **correct** pairs ?

- (1) P is  $CuI$  and M is  $I_2$  solution                      (2) P is  $CuI_2$  and M is  $I_2$  solution  
(3) P is  $CuI$  and M is  $KI_3$  solution                      (4) P is  $CuI_2$  and M is  $KI_3$  solution

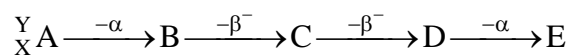
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SPACE FOR ROUGH WORK

Q.29 What is the major product of the given reaction ?



Q.30 For the following sequential radioactive decay-



the only **correct** statement is -

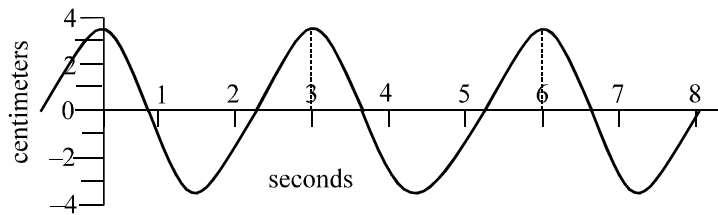
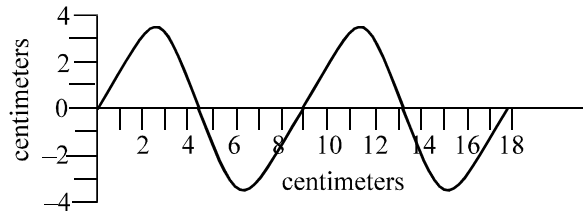
- |                                   |                           |
|-----------------------------------|---------------------------|
| (1) atomic number of E is (X + 2) | (2) A and E are isosters. |
| (3) Mass no. of D is (Y - 8)      | (4) B and D are isobars.  |

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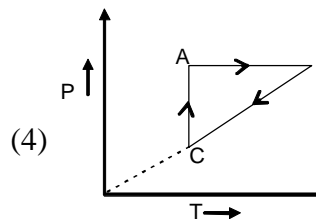
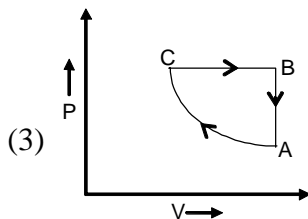
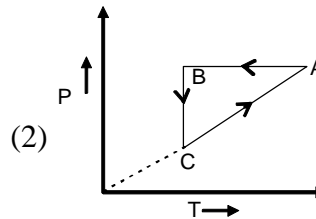
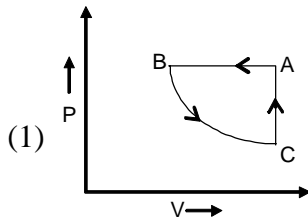
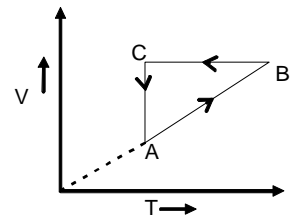
# PHYSICS

Q.31 A transverse wave is travelling along a horizontal string. The first picture shows the shape of the string at an instant of time. This picture is superimposed on a coordinate system to help you make any necessary measurements. The second picture is a graph of the vertical displacement of *one* point along the string as a function of time. How far does this wave travel along the string in one second?



- (1) 0.3 cm                      (2) 3.0 cm                      (3) 9.0 cm                      (4) 27 cm

Q.32 A cyclic process of an enclosed gas of constant mass is represented by volume (V) against absolute temperature (T) as shown. If P represents pressure, the graph representing the same process can be



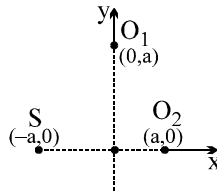
SPACE FOR ROUGH WORK



Q.33 A closed organ pipe is vibrating in its second overtone. The length of the pipe is 10cm and maximum amplitude of vibration of particles of the air in the pipe is 2mm. Then the amplitude of S.H.M. of the particles at 9cm from the open end is:

- (1)  $\sqrt{3}$  mm                      (2)  $\sqrt{2}$  mm                      (3)  $\frac{\sqrt{3}}{2}$  mm                      (4) none of these

Q.34 A sound source S and observers  $O_1$ ,  $O_2$  are placed as shown. S is always at rest and  $O_1$ ,  $O_2$  start moving with velocity  $v_0$  at  $t = 0$ . At any later instant, let  $f_1$  and  $f_2$  represent apparent frequencies of sound received by  $O_1$  and  $O_2$ , respectively. The ratio  $f_1/f_2$  is



- (1) zero                      (2) between 0 and 1                      (3) 1                      (4)  $> 1$

Q.35 Equal masses of three liquids A, B and C have temperatures  $10^\circ\text{C}$ ,  $25^\circ\text{C}$  and  $40^\circ\text{C}$  respectively. If A and B are mixed, the mixture has a temperature of  $15^\circ\text{C}$ . If B and C are mixed, the mixture has a temperature of  $30^\circ\text{C}$ . If A and C are mixed the mixture will have a temperature of

- (1)  $16^\circ\text{C}$                       (2)  $20^\circ\text{C}$                       (3)  $25^\circ\text{C}$                       (4)  $29^\circ\text{C}$

Q.36 A steel rod is 4.000 cm in diameter at  $30^\circ\text{C}$ . A brass ring has an interior diameter of 3.992 cm at  $30^\circ\text{C}$ . In order that the ring just slides onto the steel rod, the common temperature of the two should be nearly ( $\alpha_{\text{steel}} = 11 \times 10^{-6}/^\circ\text{C}$  and  $\alpha_{\text{brass}} = 19 \times 10^{-6}/^\circ\text{C}$ )

- (1)  $200^\circ\text{C}$                       (2)  $250^\circ\text{C}$                       (3)  $280^\circ\text{C}$                       (4)  $400^\circ\text{C}$

Q.37 A hot liquid is kept in a big room. The logarithm of the numerical value of the temperature difference between the liquid and the room is plotted against time. The plot will be very nearly.

- (1) a straight line                      (2) a circular arc                      (3) a parabola                      (4) exponential decay

Q.38 A body cools from  $80^\circ\text{C}$  to  $50^\circ\text{C}$  in 5 minutes. Calculate the time it takes to cool from  $60^\circ\text{C}$  to  $30^\circ\text{C}$ . The temperature of the surroundings is  $20^\circ\text{C}$ .

- (1) 10 min                      (2) 15 min                      (3) 20 min                      (4) 5 min

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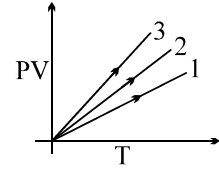
**SPACE FOR ROUGH WORK**

- Q.39 A sinusoidal wave (longitudinal or transverse) is propagating through a medium in the direction of -ve x-axis. The parameters of the waves are A,  $\omega$  and k. The particle at  $x = \lambda/4$  executes the motion  $y(t) = A \sin \omega t$ . Possible equation of the wave is
- (1)  $y(x, t) = A \sin[\omega t - kx + (\pi/2)]$                       (2)  $y(x, t) = A \sin[\omega t + kx + (\pi/2)]$   
 (3)  $y(x, t) = A \sin[\omega t - kx - (\pi/2)]$                       (4)  $y(x, t) = A \sin[\omega t + kx - (\pi/2)]$

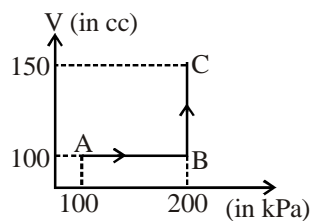
- Q.40 PV versus T graph of equal masses of  $H_2$ , He and  $CO_2$  is shown in figure.

Choose the correct alternative

- (1) 3 corresponds to  $H_2$ , 2 to He and 1 to  $CO_2$   
 (2) 1 corresponds to He, 2 to  $H_2$  and 3 to  $CO_2$   
 (3) 1 corresponds to He, 3 to  $H_2$  and 2 to  $CO_2$   
 (4) 1 corresponds to  $CO_2$ , 2 to  $H_2$  and 3 to He



- Q.41 A monoatomic gas is taken from A to C as shown in the figure. The temperature of gas at B is  $27^\circ C$ , then the change in internal energy of the gas is

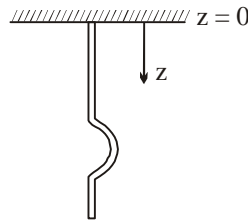


- (1) 15 J                      (2) 20 J                      (3) 30 J                      (4) 25 J

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SPACE FOR ROUGH WORK

- Q.42 A rope hangs from a rigid support. A pulse is set by jiggling the bottom end. We want to design a rope in which velocity  $v$  of pulse is independent of  $z$ , the distance of the pulse from fixed end of the rope. If the rope is very long the desired function for mass per unit length  $\mu(z)$  in terms of  $\mu_0$  (mass per unit length of the rope at the top ( $z = 0$ ),  $g$ ,  $v$  and  $z$  is :



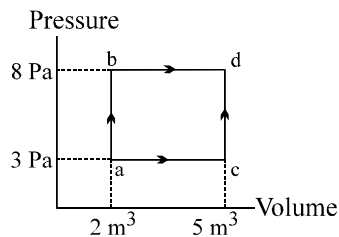
(1)  $\mu(z) = \mu_0 e^{-[g/v^2]z}$

(2)  $\mu(z) = \mu_0 e^{+[g/v^2]z}$

(3)  $\mu(z) = \mu_0 \log_e \left( \frac{g}{v^2} \right) z$

(4)  $\mu(z) = \mu_0 e + \left( \frac{v^2}{g} \right) z$

- Q.43 In the Pressure versus Volume graph shown, in the process of going from a to b 60 J of heat is added, and in the process of going from b to d 20 J of heat is added. In the process of going from a to c to d, what is the total heat added?



- (1) 80 J                      (2) 65 J                      (3) 60 J                      (4) 56 J
- Q.44 A glass tube of 1.0 meter length is filled with water. The water can be drained out slowly at the bottom of the tube. If a vibrating tuning fork of frequency 500Hz is brought at the upper end of the tube and the velocity of sound is 330m/s then the total number of resonances obtained will be
- (1) 4                      (2) 3                      (3) 2                      (4) 1

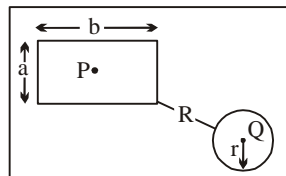
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**SPACE FOR ROUGH WORK**

Q.45 A body of mass 25 kg is dragged on a rough horizontal floor for one hour with a speed of 2km/h. The coefficient of friction between the body and the surface in contact is 0.5 and half the heat produced is absorbed by the body. If specific heat of body is  $0.1 \text{ cal g}^{-1} (^{\circ}\text{C})^{-1}$ , then the rise in temperature of body is

- (1) 50 K                      (2) 23.8 K                      (3) 100 K                      (4) 11.9 K

Q.46 There is a rectangular metal plate in which two cavities in shape of rectangle and circle are made, as shown in figure, with dimensions. P & Q are centres of these cavities. On heating the plate which of the following quantities increases.

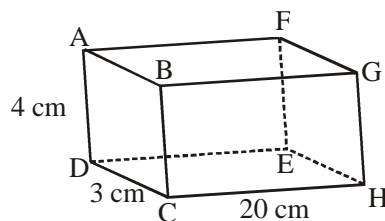


- (1)  $\pi r^2$                       (2)  $ab$                       (3)  $R$                       (4) A, B, C are all correct

Q.47 A block of wood is floating in water at  $0^{\circ}\text{C}$ . The temperature of only water is slowly raised from  $0^{\circ}\text{C}$  to  $10^{\circ}\text{C}$ . With the rise in temperature of the water the volume of block above water level will be

- (1) increase                      (2) decrease  
(3) first increase and then decrease                      (4) first decrease and then increase

Q.48 A rectangular block of lead has dimensions  $4 \text{ cm} \times 3 \text{ cm} \times 20 \text{ cm}$ . A temperature difference of  $100^{\circ}\text{C}$  can be applied to any pair of opposite faces that we choose.



- (1) The largest amount of heat flows if it flows parallel to line BG.  
(2) The largest amount of heat flows if it flows parallel to line AD.  
(3) The smallest amount of heat flows if it flows parallel to AF.  
(4) The smallest amount of heat flows if it flows parallel to AB.

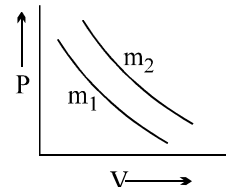
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**SPACE FOR ROUGH WORK**

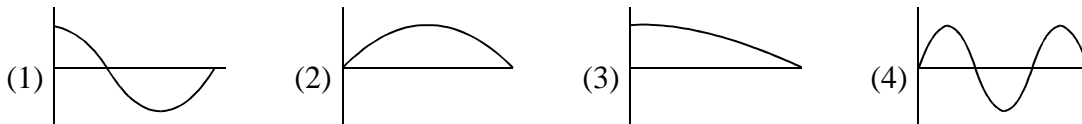
- Q.49 Two identical solid spheres have the same constant temperature. One of the spheres is cut into two identical pieces. These two hemispheres are then separated. The intact sphere radiates an energy  $Q$  during a given time interval at temperature  $T_0$ . During the same interval, the two hemisphere radiate at total energy  $Q'$  at temperature  $T_0$ . Emissivity of all the surfaces is same. The ratio  $Q'/Q$  has value :  
 (1) 0.50 (2) 0.75 (3) 2.0 (4) 1.5

- Q.50 An ideal gas obeys a law  $V^2P = \text{constant}$ . The gas is initially at temperature  $T$  and have volume  $V$ . As it expands to  $2V$  the temperature becomes  
 (1)  $2T$  (2)  $3T$  (3)  $T$  (4)  $T/2$

- Q.51 Two different isotherms representing the relationship between pressure  $P$  and volume  $V$  at a same temperature of the same ideal gas are shown for masses  $m_1$  and  $m_2$  of the gas respectively in the figure given, then:  
 (1)  $m_1 > m_2$  (2)  $m_1 = m_2$   
 (3)  $m_1 < m_2$  (4) All of the above are possible



- Q.52 Which of the figures, which show the pressure difference from regular atmospheric pressure for an organ pipe of length  $L$  closed at one end, corresponds to the 1<sup>st</sup> overtone for the pipe?



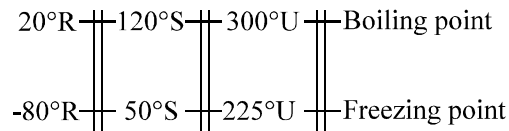
- Q.53 A car blowing a horn of frequency 350 Hz is moving normally towards a wall with a speed of 5 m/s. The beat frequency heard by a person standing between the car and the wall is (speed of sound in air = 350 m/s)  
 (1) zero (2) 3.5 Hz (3) 5 Hz (4) 10 Hz

- Q.54 The quantity  $\frac{pV}{kT}$  represents  
 (1) mass of the gas (2) kinetic energy of the gas  
 (3) number of molecules in the gas (4) number of moles of the gas

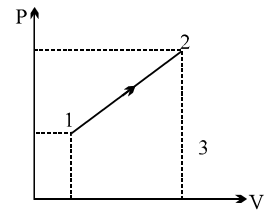
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- Q.55 Figure shows three temperature scales with the freezing and boiling point of water indicated. A change of  $25 R^{\circ}$ ,  $25 S^{\circ}$  and  $25 U^{\circ}$  is denoted by  $x_1$ ,  $x_2$ ,  $x_3$  respectively. Which of the following is correct:



- (1)  $x_1 > x_2 > x_3$       (2)  $x_2 < x_1 < x_3$       (3)  $x_3 > x_2 > x_1$       (4)  $x_2 > x_3 > x_1$
- Q.56 One end of a conducting rod is maintained at temperature  $50^{\circ}\text{C}$  and at the other end, ice is melting at  $0^{\circ}\text{C}$ . The rate of melting of ice is doubled if:
- (1) The temperature is made  $200^{\circ}\text{C}$  and the area of cross-section of the rod is doubled.  
 (2) The temperature is made  $100^{\circ}\text{C}$  and length of rod is made four times.  
 (3) Area of cross-section of rod is halved and length is doubled.  
 (4) The temperature is made  $100^{\circ}\text{C}$  and the area of cross-section of rod and length both are doubled.
- Q.57 Consider a solar system with planets that revolve around the sun in circular orbits. The temperature ( $T$ ) of a planet having no atmosphere situated at a distance  $r$  from the sun varies as
- (1)  $T \propto r^4$       (2)  $T \propto r^{4/3}$       (3)  $T \propto r^3$       (4)  $T \propto r^{-1/2}$
- Q.58 The order of magnitude of the number of nitrogen molecules in an air bubble of diameter 2 mm under ordinary conditions (pressure = 1 atm; temperature =  $27^{\circ}\text{C}$ ) is:
- (1)  $10^5$       (2)  $10^9$       (3)  $10^{13}$       (4)  $10^{17}$
- Q.59 A process  $1 \rightarrow 2$  using diatomic gas is shown on the P–V diagram on the right.  $P_2 = 2P_1 = 10^6 \text{ N/m}^2$ ,  $V_2 = 4V_1 = 0.4 \text{ m}^3$ . The molar heat capacity of the gas in this process will be
- (1)  $\frac{35R}{12}$       (2)  $\frac{25R}{13}$   
 (3)  $\frac{35R}{11}$       (4)  $\frac{22R}{7}$




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# MATHEMATICS

Q.61 Let  $f(x)$  be a one-to-one function such that  $f(1) = 3$ ,  $f(3) = 1$ ,  $f'(1) = -4$  and  $f'(3) = 2$ . If  $g = f^{-1}$ , then the slope of the tangent line to  $\frac{1}{g}$  at  $x = 1$  is

- (1)  $\frac{1}{\sqrt{2}}$                       (2)  $\frac{-1}{9}$                       (3)  $\frac{-1}{18}$                       (4)  $\frac{1}{32}$

Q.62 The value of  $\lim_{t \rightarrow 0} \ln \left( \frac{1}{t} \int_0^t (1 + 2 \sin 3x)^{4/x} dx \right)$  is equal to

- (1) 6                      (2) 12                      (3) 18                      (4) 24

Q.63 If  $g(x^3 + 1) = x^6 + x^3 + 2$ , then the value of  $g(x^2 - 1)$  is

- (1)  $x^4 - 3x^2 + 3$                       (2)  $x^4 + x^2 + 4$                       (3)  $x^4 - 3x^2 + 4$                       (4)  $x^4 + x^2 + 2$

Q.64 Suppose that  $f(0) = 0$  and  $f'(0) = 2$ , and let  $g(x) = f(-x + f(f(x)))$ . The value of  $g'(0)$  is equal to

- (1) 0                      (2) 1                      (3) 6                      (4) 8

Q.65 The value of the definite integral,  $\int_1^{\infty} (e^{x+1} + e^{3-x})^{-1} dx$  is

- (1)  $\frac{\pi}{4e^2}$                       (2)  $\frac{\pi}{4e}$                       (3)  $\frac{1}{e^2} \left( \frac{\pi}{2} - \tan^{-1} \frac{1}{e} \right)$                       (4)  $\frac{\pi}{2e^2}$

Q.66 A line  $L$  is perpendicular to the curve  $y = \frac{x^2}{4} - 2$  at its point  $P$  and passes through  $(10, -1)$ . The coordinates of the point  $P$  are

- (1)  $(2, -1)$                       (2)  $(6, 7)$                       (3)  $(0, -2)$                       (4)  $(4, 2)$

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Q.67 If  $f(x) = \max. \left( x^4, x^2, \frac{1}{81} \right) \forall x \in [0, \infty)$ , then the sum of the square of reciprocal of all the values of  $x$  where  $f(x)$  is non-differentiable, is equal to

- (1) 1                      (2) 81                      (3) 82                      (4)  $\frac{82}{81}$

Q.68 Given:  $f(x) = 4 - \left( \frac{1}{2} - x \right)^{2/3}$ ,  $g(x) = \begin{cases} \frac{\tan [x]}{x}, & x \neq 0 \\ 1, & x = 0 \end{cases}$

$$h(x) = \{x\}, k(x) = 5^{\log_2(x+3)}$$

then in  $[0, 1]$ , Lagranges Mean Value Theorem is NOT applicable to

- (1)  $f, g, h$                       (2)  $h, k$                       (3)  $f, g$                       (4)  $g, h, k$

[Note : where  $[x]$  and  $\{x\}$  denote the greatest integer and fractional part function of  $x$  respectively]

Q.69 If the function  $f(x) = ax e^{-bx}$  has a local maximum at the point  $(2, 10)$ , then

- (1)  $a = 5; b = 0$                       (2)  $a = 5e, b = 1/2$                       (3)  $a = 5e^2, b = 1$                       (4) none

Q.70 Suppose,  $f(x, n) = \sum_{k=1}^n \log_x \left( \frac{k}{x} \right)$ , then the value of  $x$  satisfying the equation  $f(x, 10) = f(x, 11)$ , is

- (1) 9                      (2) 10                      (3) 11                      (4) none

Q.71  $\lim_{n \rightarrow \infty} \sum_{r=1}^{r=4n} \frac{\sqrt{n}}{\sqrt{r}(3\sqrt{r} + 4\sqrt{n})^2}$  is equal to

- (1)  $\frac{1}{35}$                       (2)  $\frac{1}{14}$                       (3)  $\frac{1}{10}$                       (4)  $\frac{1}{5}$

SPACE FOR ROUGH WORK



Q.72 Number of integral solutions of the equation  $\operatorname{sgn}\left(\sin^{-1}\left[\frac{\pi x}{6}\right]\right) = 1$ , is

[Note : where  $[x]$  denotes the greatest integer less than or equal to  $x$  and  $\operatorname{sgn} x$  denotes signum function of  $x$ .]

- (1) 2 (2) 3 (3) 5 (4) 7

Q.73 The area bounded by the curve  $y = x^2 + 4x + 5$ , the axes of co-ordinates & the minimum ordinate is

- (1)  $3\frac{2}{3}$  (2)  $4\frac{2}{3}$  (3)  $5\frac{2}{3}$  (4)  $\frac{8}{3}$

Q.74 The differential equation of all parabolas having their axis of symmetry coinciding with the axis of  $x$  has its order and degree respectively

- (1) (2, 1) (2) (2, 2) (3) (1, 2) (4) (1, 1)

Q.75 Number of roots of the equation  $x^2 - 2x - \log_2 |1 - x| = 3$  is

- (1) 4 (2) 2 (3) 1 (4) 0

Q.76 Let  $F(x)$  be the primitive of  $\frac{3x+2}{\sqrt{x-9}}$  w.r.t.  $x$ . If  $F(10) = 60$  then the value of  $F(13)$ , is

- (1) 66 (2) 132 (3) 248 (4) 264

Q.77 If  $f(x) = \begin{cases} x^2 \left\{ e^{\frac{1}{x}} \right\}; & x \neq 0 \\ k; & x = 0 \end{cases}$

is continuous at  $x = 0$ , then

[Note :  $\{x\}$  denotes fractional part of  $x$ .]

- (1)  $f(x)$  is differentiable at  $x = 0$   
(2)  $k = 1$   
(3)  $f(x)$  is continuous but not differentiable at  $x = 0$   
(4)  $f(x)$  is continuous every where in its domain.

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Q.78  $\int \frac{\cos^3 x + \cos^5 x}{\sin^2 x + \sin^4 x} dx$  is equal to

- (1)  $\sin x - 6 \tan^{-1}(\sin x) + C$                       (2)  $\sin x - 2 \sin^{-1} x + C$   
 (3)  $\sin x - 2 (\sin x)^{-1} - 6 \tan^{-1}(\sin x) + C$                       (4)  $\sin x - 2 (\sin x)^{-1} + 5 \tan^{-1}(\sin x) + C$

[Note : where C is constant of integration.]

Q.79 Point 'A' lies on the curve  $y = e^{-x^2}$  and has the coordinate  $(x, e^{-x^2})$  where  $x > 0$ . Point B has the coordinates  $(x, 0)$ . If 'O' is the origin then the maximum area of the triangle AOB is

- (1)  $\frac{1}{\sqrt{e}}$                       (2)  $\frac{1}{\sqrt{8e}}$                       (3)  $\frac{1}{\sqrt{2e}}$                       (4)  $\frac{1}{\sqrt{4e}}$

Q.80 Let  $f(x) = \begin{cases} 3 \sin x + a^2 - 10a + 30, & x \notin Q \\ 4 \cos x, & x \in Q \end{cases}$ .

Which one of the following statement is correct ?

- (1)  $f(x)$  is continuous for all  $x$  when  $a = 5$ .  
 (2)  $f(x)$  is discontinuous for all  $x$ .  
 (3)  $f(x)$  is continuous for all  $x = 2n\pi - \tan^{-1}\left(\frac{3}{4}\right)$ ,  $n \in I$  when  $a = 5$ .  
 (4)  $f(x)$  is continuous for all  $x = 2n\pi - \tan^{-1}\left(\frac{4}{3}\right)$ ,  $n \in I$  when  $a = 5$ .

Q.81 If  $x = \tan^{-1} 1 - \cos^{-1}\left(-\frac{1}{2}\right) + \sin^{-1}\frac{1}{2}$  ;  $y = \cos\left(\frac{1}{2} \cos^{-1}\left(\frac{1}{8}\right)\right)$  then :

- (1)  $x = \pi y$                       (2)  $y = \pi x$                       (3)  $\tan x = -(4/3)y$                       (4)  $\tan x = (4/3)y$

Q.82 The domain of the derivative of the function  $f(x) = \begin{cases} e^{-|x|+1}, & \text{if } |x| \leq 1 \\ ||x-4|-2|, & \text{if } |x| > 1 \end{cases}$  is

- (1)  $R - \{-2, 0, 2\}$                       (2)  $R - \{-4, -2, -1, 0, 1, 2, 4\}$   
 (3)  $R - \{-6, -4, -2, 0, 2, 4, 6\}$                       (4)  $R - \{-6, -4, -2, -1, 1, 2, 4, 6\}$

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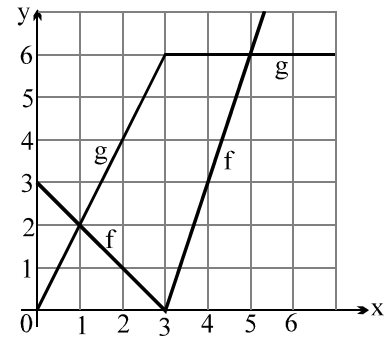
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Q.83 If  $f$  and  $g$  are the functions whose graphs are shown, let

$$P(x) = f(x)g(x), \quad Q(x) = \frac{f(x)}{g(x)} \quad \text{and} \quad C(x) = f(g(x)).$$

The value of  $(P'(2) - C'(2))Q'(2)$  equals

- (1)  $3/2$  (2\*) 3  
 (3)  $-3$  (4)  $-6$



Q.84 Let  $G(x) = \int e^x \left( \int_0^x f(t) dt + f(x) \right) dx$  where  $f(x)$  is continuous on  $\mathbb{R}$ . If  $f(0) = 1, G(0) = 0$

then  $G'(0)$  equals

- (1) 1 (2) 2 (3) 3 (4) 4

Q.85  $\lim_{n \rightarrow \infty} \frac{e^n}{\left(1 + \frac{1}{n}\right)^{n^2}}$  equals

- (1) 1 (2)  $\frac{1}{2}$  (3)  $e$  (4)  $\sqrt{e}$

Q.86 If  $\frac{dy}{dx} = (e^y - x)^{-1}$  where  $y(0) = 0$ , then  $y$  is expressed explicitly as

- (1)  $\frac{1}{2} \ln(1 + x^2)$  (2)  $\ln(1 + x^2)$  (3)  $\ln\left(x + \sqrt{1 + x^2}\right)$  (4)  $\ln\left(x + \sqrt{1 - x^2}\right)$

Q.87 The area enclosed by  $g(x)$ ,  $x = -3$ ,  $x = 5$  and  $x$ -axis where  $g(x)$  is the inverse of  $f(x) = x^3 + 3x + 1$ , is

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(1)  $\frac{5}{2}$

(2)  $\frac{7}{2}$

(3)  $\frac{9}{2}$

(4)  $\frac{11}{2}$

Q.88 Let  $J = \int_0^{e-1} \frac{1}{x+1} \exp\left(\frac{x^2+2x-1}{2}\right) dx$  and  $K = \int_1^e x \ln x \exp\left(\frac{x^2-2}{2}\right) dx$ .

The value of  $(J + K)$  is equal to

(1)  $(\sqrt{e})^{e^2+1}$

(2)  $(\sqrt{e})^{e^2-1}$

(3) 0

(4)  $(\sqrt{e})^{e^2-2}$

Q.89 The graphs  $y = 2x^3 - 4x + 2$  and  $y = x^3 + 2x - 1$  intersect in exactly 3 distinct points. The slope of the line passing through two of these points

(1) is equal to 4

(2) is equal to 6

(3) is equal to 8

(4) is not unique

Q.90 The value of  $\lim_{n \rightarrow \infty} \left( \sum_{r=1}^n \left( \frac{2r+5}{r^2+r} \right) \left( \frac{3}{5} \right)^{r+1} \right)$  is equal to

(1) 2

(2)  $\frac{9}{5}$

(3)  $\frac{6}{5}$

(4) none

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