LEVEL #1

Questions based on Work

Q.1 A man pushes a wall and fails to displace it. He does -
(A) negative work
(B) positive but not maximum work
(C) no work at all
(D) maximum work

Q.2 Work done in time t on a body of mass m which is accelerated from rest to a speed υ in time t_1 as a function of time t is given by-

(A) $\frac{1}{2}m\frac{\upsilon}{t_1}t^2$ (B) $m\frac{\upsilon}{t_1}t^2$

(C) $\frac{1}{2}m\left(\frac{\upsilon}{t_1}\right)^2 t^2$ (D) $\frac{1}{2}m\frac{\upsilon^2}{t_1^2}t^2$

Q.3 A particle moves under the effect of a force F = c x from x = 0 to x = x_1. The work done in the process is-

(A) $c\,x_1^2$ (B) $\frac{1}{2}c\,x_1^2$

(C) $c\,x_1^3$ (D) zero.

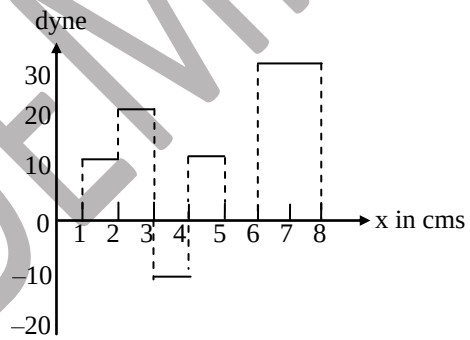
Q.4 A body travels through a distance of 10 m on a straight line, under the influence of 5 N . If the work done by the force is 25J, the angle between the force and displacement is-
(A) 0º (B) 30º (C) 60º (D) 90º

Q.5 The work done in pushing a block of mass 10 kg from bottom to the top of a frictionless inclined plane 5 m long and 3 m high is-
(g = 9.8 m/sec^2)
(A) 392 J (B) 294 J
(C) 98 J (D) 0.98 J

Q.6 A force **F** = $(3x\hat{i} + 4\hat{j})$ Newton (where x is in metres) acts on a particle which moves from a position (2m, 3m) to (3m, 0m). Then the work done is
(A) 7.5J (B) –12J
(C) –4.5 J (D) +4.5 J

Q.7 A chain of mass M is placed on a smooth table with 1/n of its length L hanging over the edge. The work done in pulling the hanging portion of the chain back to the surface of the table is -
(A) MgL/n (B) MgL/2n
(C) MgL/n^2 (D) MgL/$2n^2$

Q.8 The relationship between force and position is shown in fig (in one dimensional case). The work done in displacing a body from x = 1cm to x = 5 cm is :



(A) 30 erg (B) 60 erg
(C) 70 erg (D) 700 erg

Q.9 A force $\vec{F} = 2\hat{i} - 3\hat{j} + 7\hat{k}$ (N) acts on a particle which undergoes a displacement $\vec{r} = 7\hat{i} + 3\hat{j} - 2\hat{k}$ (M). Calculate the work done by the force-
(A) 37 J (B) –9 J
(C) 49 J (D) 14 J

Questions based on Kinetic energy & work energy Theorem

Q.10 A light and a heavy body have equal momentum. Which one has greater K.E.?
(A) the light body
(B) both have equal K.E.
(C) the heavy body
(D) data given is incomplete

Q.11 If a man increases his speed by 2 m/sec, his K.E. is doubled. The original speed of the man is-

(A) $(2 + \sqrt{2})$ m/s (B) $(2 + 2\sqrt{2})$ m/s
(C) 4 m/s (D) $(1 + \sqrt{2})$ m/s

Q.12 A 300 g mass has a velocity of (3i + 4j) m/s at a certain instant what is its K.E. ?
(A) 1.35 J (B) 2.4 J (C) 3.75 J (D) 7.35 J

Q.13 Two bodies of mass 1 kg and 4 kg are moving with equal kinetic energies. The ratio of their linear momentum is-
(A) 1 : 2 (B) 2 : 1 (C) 4 : 1 (D) 1 : 4

Q.14 The momentum of a body is increased by 50%. The K.E. of the body will be increased by-
(A) 50 % (B) 125 % (C) 330% (D) 400 %

Q.15 A blocks is moved from rest through a distance of 4m along a straight line path. The mass of the blocks is 5 kg. and the force acting on it is 20 N. If the kinetic energy acquired by the block be 40J, at what angle to the path the force is acting-
(A) 30º (B) 60º
(C) 45º (D)none of the above

Q.16 A body of mass 2 kg fall vertically, passing through two points A and B. The speeds of the body as it passes A and B are 1 m/s and 4m/s respectively. The resistance against which the body falls is 9.6N. What is the distance AB?
(A) 2m (B) 3m (C) 6m (D) 1.5 m

Q.17 A force 'F' stops a body of mass 'm' moving with a velocity 'u' in a distance 's'. The force required to stop a body of double the mass moving with double the velocity in the same distance is -
(A) 2F (B) 4F
(C) 6F (D) 8F

Questions based on **Potential energy & Conservation of mechanical energy**

Q.18 If the unit of force and length be each increased by four times, then the unit of energy is increased by-
(A) 16 times (B) 8 times
(C) 2 times (D) 4 times

Q.19 Two springs A and B($k_A = 2k_B$) are stretched by applying forces of equal magnitudes at the four ends. If the energy stored in A is E, that in B is-
(A) E/2 (B) 2E (C) E (D) E/4

Q.20 _____ of a two particle system depends only on the separation between the two particles. The most appropriate choice for the blank space in the above sentence is -
(A) kinetic energy
(B) total mechanical energy
(C) potential energy
(D) total energy

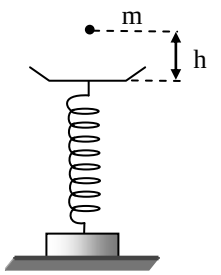
Q.21 The principle of conservation of energy implies that-
(A) the total mechanical energy is conserved.
(B) the total kinetic energy is conserved
(C) the total potential energy is conserved.
(D) sum of all types of energies is conserved.

Q.22 There will be an increase in potential energy of the system if work is done upon the system by-
(A) any conservation or non-conservation forces
(B) a non-conservative force
(C) a conservation force
(D) none of the above

Q.23 The work done by the external forces on a system equals the change in -
(A) total mechanical energy
(B) kinetic energy
(C) potential energy
(D) none of these

Q.24 The work done by all the forces (external and internal) on a system equals the change in
(A) total energy (B) kinetic energy
(C) potential energy (D) none of these

Q.25 A ball of mass m is dropped from a height h on a platform fixed at the top of a vertical spring. The platform is displaced by a distance x. The spring constant is



(A) $\frac{2mg}{x}$ (B) $\frac{2mgh}{x^2}$

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

Q.26 A body is dropped from a certain height. When it lost an amount of P.E. 'U', it acquires a velocity 'υ'. The mass of the body is-

(A) $\frac{2U}{\upsilon^2}$ (B) $\frac{2\upsilon}{U^2}$ (C) $\frac{2\upsilon}{U}$ (D) $\frac{U^2}{2\upsilon}$

Q.27 A lead bullet of specific heat 's' moving with a velocity v strikes a wall and stops. If half of its energy is converted into heat, the rise in its temperature will be-
[where s is in cal/kg - ^oc]

(A) $\frac{v^3s}{J}$ (B) $\frac{2V^2}{Js}$ (C) $\frac{V^2}{4Js}$ (D) $\frac{V^2s}{2J}$

Q.28 A block of mass m slides down along the surface of the bowl (radius R) from the rim to the bottom. The velocity of the block at the bottom will be-

(A) $\sqrt{(\pi Rg)}$ (B) $2\sqrt{(\pi Rg)}$

(C) $\sqrt{(2Rg)}$ (D) $\sqrt{(gR)}$

Q.29 A sphere is suspended by a thread of length l. What minimum horizontal velocity is to be imparted to the sphere for it to reach the height of suspension ?

(A) $\sqrt{8\ell}$ (B) g l (C) $\sqrt{2g\ell}$ (D) $\sqrt{\ell/g}$

Q.30 A body of mass m kg is rotating in a vertical circle at the end of a string of length r metre. The difference in the K.E. at the top and bottom of the circle is-

(A) mgr (B) 2mgr (C) $\frac{mg}{r}$ (D) $\frac{2mg}{r}$

Q.31 A ball of mass 2 kg is projected horizontally with a velocity 20m/s from a building of height 15m. The speed with which body hits the ground is-

(A) 20 m/s (B) $10(7)^{1/2}$ m/s

(C) 25 m/s (D) 35 m/s

Q.32 A man slides down a snow covered hill along a curved path and falls 20m below his initial position. The velocity in m/sec with which he finally strikes the ground is ($g = 10$ m/sec^2)

(A) 20 (B) 400 (C) 200 (D) 40

Questions based on Power

Q.33 A pump ejects 12000 kg of water at speed of 4 m/s in 40 second. Find the average rate at which the pump is working-

(A) 0.24 KW (B) 2.4 W

(C) 2.4 KW (D) 24 W

Q.34 An object of mass m accelerates uniformly from rest to a speed v_f in time t_f. Then the instantaneous power delivered to the object, as a function of time t is -

(A) mt $\left(\frac{v_f}{t_f}t\right)^2$ (B) mt $\frac{v_f}{t_f}$

(C) $\frac{1}{2}$ mt^2 $\left(\frac{v_f}{t_f}t\right)^2$ (D) $\frac{1}{2}$ mt^2 $\left(\frac{v_f}{t_f}t\right)$

Q.35 A self propelled vehicle of mass m whose engine delivers constant power P has an acceleration a = $\frac{P}{mv}$ (assume that there is no friction). In order to increase its velocity from v_1 to v_2, the distance it has to travel will be-

(A) $\frac{3P}{m}(v_2^2 - v_1^2)$ (B) $\frac{m}{3P}(v_2^3 - v_1^3)$

(C) $\frac{m}{3P}(v_2^2 - v_1^2)$ (D) $\frac{m}{3P}(v_2 - v_1)$

Q.36 If a force F is applied on a body and it moves with a velocity υ, the power will be-

(A) F υ (B) F / υ (C) F/υ^2 (D) F υ^2

Q.37 A body of mass m accelerates uniformly form rest to υ_1 in time t_1. As a function of t, the instantaneous power delivered to the body is-

(A) $\frac{m\upsilon_1 t}{t_1}$ (B) $\frac{m\upsilon_1^2 t}{t_1}$

(C) $\frac{m\upsilon_1 t^2}{t_1}$ (D) $\frac{m\upsilon_1^2 t}{t_1^2}$

Q.38 A body is moved along a straight line by a machine delivering constant power. The distance moved by the body in time t is proportional to-

(A) $t^{1/2}$ (B) $t^{3/4}$ (C) $t^{3/2}$ (D) t^2

Questions based on Centre of mass

Q.39 The velocity of centre of mass in absence of external force is -

(A) constant (B) zero

(C) increases (D) decreases

Q.40 The centre of mass of two particles lies

(A) on the line perpendicular to the line joining the particles

(B) on a point outside the line joining the particles

(C) on the line joining the particles.

(D) none of the above .

Q.41 Two particles A and B which are initially at rest move towards each other under the mutual force of attraction. At the instant when the speed of A is v and the speed of B is 2v. the speed of the centre of mass of the system is -

(A) v (B) 1.5v (C) 3v (D) zero

Q.42 Two particles whose masses are 10 kg and 30kg and their position vectors are $\hat{i} + \hat{j} + \hat{k}$ and $-\hat{i} - \hat{j} - \hat{k}$ respectively would have the centre of mass at -

(A) $-\frac{(\hat{i}+\hat{j}+\hat{k})}{2}$ (B) $\frac{(\hat{i}+\hat{j}+\hat{k})}{2}$

(C) $-\frac{(\hat{i}+\hat{j}+\hat{k})}{4}$ (D) $\frac{(\hat{i}+\hat{j}+\hat{k})}{4}$

Q.43 Two balls A and B of masses 100gm and 250 gm respectively are connected by a stretched spring of negligible mass and placed on a smooth table. When the balls are released simultaneously the initial acceleration of B is 10 cm/sec^2 west ward. What is the magnitude and direction of initial acceleration of the ball A-

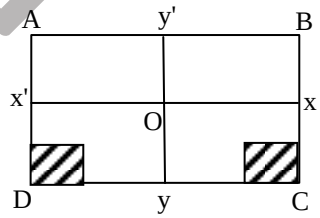
(A) 25 cm/sec^2 Eastward

(B) 25 cm/sec^2 North ward

(C) 25 cm/sec^2 West ward

(D) 25 cm/sec^2 South ward

Q.44 A uniform square plate ABCD has a mass of 10kg. If two point masses of 3 kg each are placed at the corners C and D as shown in the adjoining figure, then the centre of mass shifts to the point which is lie on –



(A) OC (B) OD (C) OY (D) OX

Q.45 The velocity of centre of mass in absence of external force is -

(A) constant (B) zero

(C) increases (D) decreases

Questions based on Conservation of linear momentum

Q.46 A bullet is fired from the gun. The gun recoils, the kinetic energy of the recoil shall be-

(A) equal to the kinetic energy of the bullet

(B) less than the kinetic energy of the bullet

(C) greater than the kinetic energy of the bullet

(D) double that of the kinetic energy of the bullet

Q.47 A bomb at rest explodes into two parts of masses m_1 and m_2 . If the momentums of the

two parts be p_1 and p_2, then their kinetic energies will be in the ratio of-

(A) m_1 / m_2 (B) m_2 / m_1

(C) p_1 / p_2 (D) p_2 / p_1

Q.48 Conservation of linear momentum is equivalent to-

(A) Newton's second law of motion

(B) Newton's first law of motion

(C) Newton's third law of motion

(D) Conservation of angular momentum.

Q.49 A body of mass m collides against a wall with the velocity υ and rebounds with the same speed. Its change of momentum is-

(A) $2m\upsilon$ (B) $m\upsilon$ (C) $-m\upsilon$ (D) 0

Q.50 A bomb initially at rest explodes by it self into three equal mass fragments. The velocities of two fragments are $(3\hat{i} + 2\hat{j})$ m/s and $(-\hat{i} - 4\hat{j})$ m/s. The velocity of the third fragment is (in m/s)-

(A) $2\hat{i} + 2\hat{j}$ (B) $2\hat{i} - 2\hat{j}$

(C) $-2\hat{i} + 2\hat{j}$ (D) $-2\hat{i} - 2\hat{j}$

Q.51 A stone of mass m_1 moving with a uniform speed v suddenly explodes on its own into two fragments. If the fragment of mass m_2 is at rest, the speed of the other fragment is -

(A) $\frac{m_1 v}{(m_1 - m_2)}$ (B) $\frac{m_2 v}{(m_1 - m_2)}$

(C) $\frac{m_1 v}{(m_1 + m_2)}$ (D) $\frac{m_1 v}{m_2}$

Q.52 A monkey of mass 20kg rides on a 40kg trolley moving with constant speed of 8m/s along a horizontal track. If the monkey jumps vertically to grab the overhanging branch of a tree, the speed of the trolley after the monkey has jumped off is -

(A) 8 m/s (B) 1 m/s

(C) 4 m/s (D) 12 m/s

Q.53 A nucleus of mass number A originally at rest emits α-particle with speed v. The recoil speed of daughter nucleus is :

(A) $\frac{4v}{A-4}$ (B) $\frac{4v}{A+4}$

(C) $\frac{v}{A-4}$ (D) $\frac{v}{A+4}$

Q.54 Two particles A and B which are initially at rest move towards each other under the mutual force of attraction. At the instant when the speed of A is v and the speed of B is 2v. The speed of the centre of mass of the system is -

(A) v (B) 1.5v

(C) 3v (D) zero

Q.55 Which of the following force is conservation force -

(A) Electrostatic (B) Frictional

(C) Viscous (D) Air resistance

Q.56 Which one of the following force is non-conservative ?

(A) Gravitational force (B) Electrostatic force

(C) Lorentz force (D) Viscous force

Q.57 An object of mass 5 kg and speed 10 ms^{-1} explodes into two pieces of equal mass. One piece comes to rest. The kinetic energy added to the system during the explosion is-

(A) Zero (B) 50 J (C) 250 J (D) 500 J

Questions based on Collision

Q.58 In an inelastic collision-

(A) momentum is conserved but kinetic energy is not

(B) momentum is not conserved but kinetic energy is conserved

(C) neither momentum nor kinetic energy is conserved

(D) both the momentum and kinetic energy are conserved

Q.59 Inelastic collision is the-

(A) collision of ideal gas molecule with the walls of the container

(B) collision of electron and positron to an inhilate each other.

(C) collision of two rigid solid spheres lying on a frictionless table

(D) scattering of α-particles with the nucleus of gold atom

Q.60 When two bodies stick together after collision, the collision is said to be-

(A) perfectly inelastic

(B) elastic

(C) inelastic

(D) none of the above is correct

Q.61 When two bodies collide elastically, then-

(A) kinetic energy of the system alone is conserved

(B) only momentum is conserved

(C) both energy and momentum are conserved

(D) neither energy nor momentum is conserved

Q.62 The coefficient of restitution e for a perfectly inelastic collision is-

(A) 1 (B) ∞ (C) Zero (D) –1

Q.63 Which of the following statements is true for collisions -

(A) momentum is conserved in elastic collisions but not in inelastic collisions.

(B) total-kinetic energy is conserved in elastic collisions but momentum is not conserved.

(C) total kinetic energy is not conserved in inelastic collisions but momentum is conserved

(D) total kinetic energy and momentum both are conserved in all types of collisions

Q.64 A particle of mass m moving with velocity V collides with particle of mass 2m at rest and adheres to it. The velocity of the system is-

(A) 2V (B) 3V (C) V/2 (D) V/3

Q.65 Consider the elastic collision of two bodies A and B of equal mass. Initially B is at rest and A moves with velocity υ. After the collision-

(A) the body A traces, its path back with the same speed

(B) the body A comes to rest and B moves always in the direction of A' s approach with the velocity υ

(C) both the bodies stick together and are at rest

(D) B moves along with velocity $\upsilon/2$ and A retraces its path with velocity $\upsilon/2$

Q.66 A particle A suffers an oblique elastic collision with a particle B that is at rest initially. If their masses are the same, then after the collision-

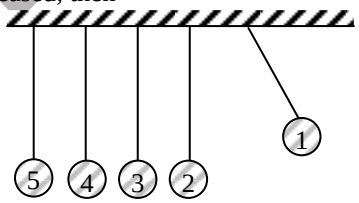
(A) they will move in opposite directions

(B) A continuous to move in the original direction while B remains at rest

(C) they will move in mutually perpendicular direction

(D) A comes to rest and B starts moving in the direction of the original motion of A

Q.67 Five identical elastic balls are so suspended with strings of equal length in a row that the distances between adjacent balls are very small. If the extreme right ball is moved aside and released, then-



(A) one extreme left hand ball will bounce off.

(B) two extreme left hand balls will bounce off.

(C) three extreme left hand balls will bounce off

(D) all the left hand four balls will bounce off.

Q.68 Before a rubber ball bounces off from the floor the ball is in contact with the floor for a fraction of second. Which of the following statements are correct-

(A) conservation of energy is not valid during this period

(B) conservation of energy is valid during this period

(C) as ball compressed kinetic energy is converted compressed potential energy

(D) 2 and 3 both

Q.69 A body of mass 'm' moving with a constant velocity v hits another body of the same mass moving with the same velocity v but in the

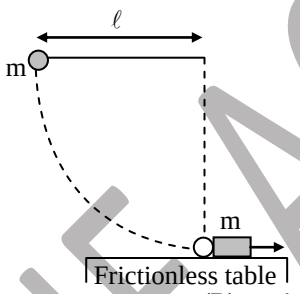
opposite direction and sticks to it. The velocity of the compound body after collision is-
(A) v (B) 2v (C) v/2 (D) 0

Q.70 A body of mass 2kg moving with a velocity of 3m/sec towards left collides head-on with a body of mass 3kg moving in opposite direction with a velocity 2m/sec. After collision the two bodies stick together and move with a common velocity which is-
(A) 5m/sec towards left
(B) 12 m/sec towards right
(C) 12/5 m/sec towards left
(D) zero

Q.71 A 1.0 kg ball drops vertically into a floor from a height of 25cm. It rebounds to a height of 4cm. The coefficient of restitution for the collision is-
(A) 0.16 (B) 0.32 (C) 0.40 (D) 0.56

Q.72 An inelastic ball is dropped from a height 100 metres. If due to impact it loses 35% of its energy the ball will rise to a height of -
(A) 35m (B) 65 m (C) 100 m (D) 135 m

Q.73 The bob of a simple pendulum of length ℓ dropped from a horizontal position strikes a block of the same mass, placed on a horizontal table (frictionless) as shown in the diagram, the block shall have kinetic energy-



(A) Zero (B) $mg\ell$
(C) $1/2\ mg\ell$ (D) $2mg\ell$

Q.74 A particle of mass m_1 hits another particle of mass m_2 at rest with a velocity $\vec{u}$. The collision is head-on and elastic. If $m_1 >> m_2$, then after collision, the velocity of m_2 will be-
(A) $\vec{u}$ (B) $-\vec{u}$ (C) $2\vec{u}$ (D) $-2\vec{u}$

Q.75 A neutron travelling with a velocity v and K.E. E. collides perfectly elastically head on with the nucleus of an atom of mass number A at rest. The fraction of total energy retained by neutron is-
(A) $\left(\frac{A-1}{A+1}\right)^2$ (B) $\left(\frac{A+1}{A-1}\right)^2$
(C) $\left(\frac{A-1}{A}\right)^2$ (D) $\left(\frac{A+1}{A}\right)^2$

Q.76 If one sphere collides head on with another sphere of the same mass at rest inelastically. The ratio of their speeds after collision shall be-
(A) $(1 - e)/(1 + e)$ (B) $2e/(1 + e)$
(C) $(1 + e)/(1 - e)$ (D) e

Q.77 Two particles of same mass m moving with velocities u_1 and u_2 collide perfectly inelastically. The loss of energy would be-
(A) $\frac{1}{2}m(u_1 - u_2)^2$ (B) $\frac{1}{4}m(u_1 - u_2)^2$
(C) $m\ (u_1 - u_2)^2$ (D) $2m\ (u_1 - u_1)^2$

Q.78 A particle of mass m_1 moving with velocity V collides head-on with a particle of mass m_2 initially at rest. The collision is completely inelastic. The fraction of the original kinetic energy that is converted into heat is-
(A) $m_1/(m_1 + m_2)$ (B) $m_2 / (m_1 + m_2)$
(C) $m_1 / (m_1 - m_2)$ (D) $m_2 / (m_1 - m_2)$

Q.79 A ball of mass m moving with a speed u undergoes a head-on elastic collision with a ball of mass nm initially at rest. The fraction of the incident energy transferred to the heavier ball is-
(A) $\frac{n}{1+n}$ (B) $\frac{n}{(1+n)^2}$
(C) $\frac{2n}{(1+n)^2}$ (D) $\frac{4n}{(1+n)^2}$

Q.80 Two elastic bodies P and Q having equal masses are moving along the same line with velocities of 16 m/s and 10m/s respectively. Their velocities after the elastic collision will be in m/s -
(A) 0 and 25 (B) 5 and 20
(C) 10 and 16 (D) 20 and 5

Q.81 Two solid balls of rubber A and B whose masses are 200gm and 400gm respectively, are moving in mutually opposite directions. If the

velocity A is 0.3 m/s and both the balls come to rest after collision, then the velocity of ball B is -

(A) 0.15 ms^{-1} (B) –0.15 ms^{-1}

(C) 1.5 ms^{-1} (D) none of these

Q.82 Two similar balls P and Q having velocities of 0.5m/s and – 0.3 m/s respectively collide elastically. The velocities of P and Q after the collision will respectively be -

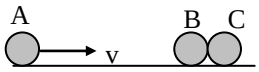
(A) – 0.5 m/s and 0.3 m/s

(B) 0.5 m/s and 0.3 m/s

(C) – 0.3 m/s and 0.5 m/s

(D) 0.3 m/s and 0.5 m/s

Q.83 As shown in figure A, B and C are identical balls B and C are at rest and, the ball A moving with velocity v collides elastically with ball B, then after collision:



(A) All the three balls move with velocity v/2

(B) A comes to rest and (B + C) moves with velocity v/$\sqrt{2}$

(C) A moves with velocity v and (B + C) moves with velocity v

(D) A and B come to rest and C moves with velocity v

LEVEL # 1

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	C	D	B	C	B	C	D	A	B	A	B	C	A	B	B	D	D	A	B	C
Q.No.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	D	C	A	B	C	A	C	C	C	B	B	A	C	A	B	A	D	C	A	C
Q.No.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	D	A	A	C	A	B	B	A	A	C	A	A	A	D	A	D	C	A	B	A
Q.No.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Ans.	C	C	C	D	B	C	A	D	D	D	C	B	B	C	A	A	B	B	D	C
Q.No.	81	82	83																	
Ans.	B	C	D																	