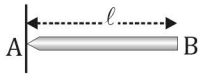
AIPMT 2006

1. A uniform rod AB of length ℓ and mass m is free to rotate about A. The rod is released from rest in the horizontal position. Given that the moment of inertia of the rod about A is $\frac{m\ell^2}{3}$, the initial angular acceleration of the rod will be :–



(1) $\frac{3g}{2\ell}$ (2) $\frac{2g}{3\ell}$ (3) $mg\frac{\ell}{2}$ (4) $\frac{3}{2}g\ell$

AIPMT 2009

2. Four identical thin rods each of mass M and length ℓ, form a square frame. Moment of inertia of this frame about an axis through the centre of the square and perpendicular to its plane is :-

(1) $\frac{1}{3}M\ell^2$ (2) $\frac{4}{3}M\ell^2$

(3) $\frac{2}{3}M\ell^2$ (4) $\frac{13}{3}M\ell^2$

3. If $\vec{F}$ is the force acting on a particle having position vector $\vec{r}$ and $\vec{\tau}$ be the torque of this force about the origin, then :-

(1) $\vec{r}\cdot\vec{\tau}=0$ and $\vec{F}\cdot\vec{\tau}\neq 0$

(2) $\vec{r}\cdot\vec{\tau}\neq 0$ and $\vec{F}\cdot\vec{\tau}=0$

(3) $\vec{r}\cdot\vec{\tau}>0$ and $\vec{F}\cdot\vec{\tau}<0$

(4) $\vec{r}\cdot\vec{\tau}=0$ and $\vec{F}\cdot\vec{\tau}=0$

4. A thin circular ring of mass M and radius R is rotating in a horizontal plane about an axis vertical to its plane with a constant angular velocity ω. If two objects each of mass m be attached gently to the opposite ends of a diameter of the ring, the ring will then rotate with an angular velocity :-

(1) $\frac{\omega M}{M+m}$ (2) $\frac{\omega(M-2m)}{M+2m}$

(3) $\frac{\omega M}{M+2m}$ (4) $\frac{\omega(M+2m)}{M}$

AIPMT (Pre) 2011

5. The instantaneous angular position of a point on a rotating wheel is given by the equation $\theta(t) = 2t^3 - 6t^2$. The torque on the wheel becomes zero at :-

(1) t = 1s (2) t = 0.5 s

(3) t = 0.25 s (4) t = 2s

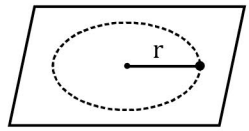
6. The moment of inertia of a thin uniform rod of mass M and length L about an axis passing through its midpoint and perpendicular to its length is I_0. Its moment of inertia about an axis passing through one of its ends and perpendicular to its length is:-

(1) $I_0 + ML^2/2$ (2) $I_0 + ML^2/4$

(3) $I_0 + 2ML^2$ (4) $I_0 + ML^2$

AIPMT (Mains) 2011

7. A small mass attached to a string rotates on a frictionless table top as shown. If the tension in the string is increased by pulling the string causing the radius of the circular motion to decrease by a factor of 2, the kinetic energy of the mass will :-



(1) Decrease by a factor of 2

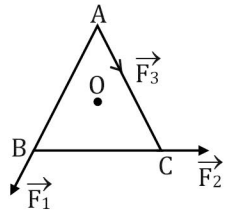
(2) Remain constant

(3) Increase by a factor of 2

(4) Increase by a factor of 4

AIPMT (Pre) 2012

8. ABC is an equilateral triangle with O as its centre. $\vec{F}_1, \vec{F}_2$ and $\vec{F}_3$ represent three forces acting along the sides AB, BC and AC respectively. If the total torque about O is zero then the magnitude of $\vec{F}_3$ is :-



(1) $\frac{F_1+F_2}{2}$ (2) $2(F_1 + F_2)$

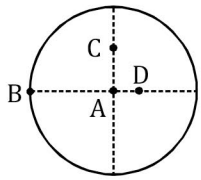
(3) $F_1 + F_2$ (4) $F_1 - F_2$

9. When a mass is rotating in a plane about a fixed point, its angular momentum is directed along :-
(1) the radius
(2) the tangent to the orbit
(3) a line perpendicular to the plane of rotation
(4) the line making an angle of 45° to the plane of rotation.

10. A solid cylinder of mass 3 kg is rolling on a horizontal surface with velocity 4 m/s. It collides with a horizontal spring of force constant 200 N/m. The maximum compression produced in the spring will be :-
(1) 0.7 m (2) 0.2 m
(3) 0.5 m (4) 0.6 m

AIPMT (Mains) 2012

11. The moment of inertia of a uniform circular disc is maximum about an axis perpendicular to the disc and passing through :-



(1) D (2) A (3) B (4) C

12. A circular platform is mounted on a frictionless vertical axle. Its radius R = 2m and its moment of inertia about the axle is 200 kg m^2. It is initially at rest. A 50 kg man stands on the edge of the platform and begins to walk along the edge at the speed of 1 m/s relative to the ground. Time taken by the man to complete one revolution is :-

(1) 2π s (2) $\frac{\pi}{2}$ s (3) π s (4) $\frac{3\pi}{2}$ s

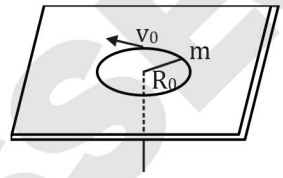
AIPMT 2014

13. A solid cylinder of mass 50 kg and radius 0.5 m is free to rotate about the horizontal axis. A massless string is wound round the cylinder with one end attached to it and other hanging freely. Tension in the string required to produce an angular acceleration of 2 revolutions/s^2 is :-
(1) 25 N (2) 50 N
(3) 78.5 N (4) 157 N

14. The ratio of the accelerations for a solid sphere (mass 'm' and radius 'R') rolling down an incline of angle 'θ' without slipping and slipping down the incline without rolling is :-
(1) 5 : 7 (2) 2 : 3 (3) 2 : 5 (4) 7 : 5

AIPMT 2015

15. A mass m moves in a circle on a smooth horizontal plane with velocity v_0 at a radius R_0. The mass is attached to a string which passes through a smooth hole in the plane as shown.



The tension in the string is increased gradually and finally m moves in a circle of radius $\frac{R_0}{2}$. The final value of the kinetic energy is :-

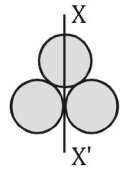
(1) $\frac{1}{4}mv_0^2$ (2) $2mv_0^2$ (3) $\frac{1}{2}mv_0^2$ (4) mv_0^2

16. A rod of weight W is supported by two parallel knife edges A and B and is in equilibrium in a horizontal position. The knives are at a distance d from each other. The centre of mass of the rod is at distance x from A. The normal reaction on A is :-

(1) $\frac{Wd}{x}$ (2) $\frac{W(d-x)}{x}$

(3) $\frac{W(d-x)}{d}$ (4) $\frac{Wx}{d}$

17. Three identical spherical shells, each of mass m and radius r are placed as shown in figure. Consider an axis XX' which is touching to two shells and passing through diameter of third shell. Moment of inertia of the system consisting of these three spherical shells about XX' axis is :-



(1) $3\ mr^2$ (2) $\frac{16}{5}mr^2$

(3) $4\ mr^2$ (4) $\frac{11}{5}mr^2$

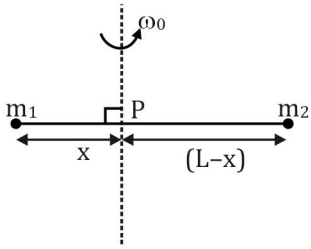
Re-AIPMT 2015

18. An automobile moves on a road with a speed of 54 km/h. The radius of its wheels is 0.45 m and the moment of inertia of the wheel about its axis of rotation is 3 kg-m^2. If the vehicle is brought to rest in 15s, the magnitude of average torque transmitted by its brakes to wheel is :-

(1) 2.86 kg-m^2/s^2 (2) 6.66 kg-m^2/s^2

(3) 8.58 kg-m^2/s^2 (4) 10.86 kg-m^2/s^2

19. Point masses m_1 and m_2 are placed at the opposite ends of a rigid rod of length L, and negligible mass. The rod is to be set rotating about an axis perpendicular to it. The position of point P on this rod through which the axis should pass so that the work required to set the rod rotating with angular velocity ω_0 is minimum, is given by :-



(1) $x = \frac{m_2 L}{m_1 + m_2}$ (2) $x = \frac{m_1 L}{m_1 + m_2}$

(3) $x = \frac{m_1}{m_2} L$ (4) $x = \frac{m_2}{m_1} L$

20. A force $\vec{F} = \alpha\hat{i} + 3\hat{j} + 6\hat{k}$ is acting at a point $\vec{r} = 2\hat{i} - 6\hat{j} - 12\hat{k}$. The value of α for which angular momentum about origin is conserved is :-

(1) 1 (2) –1 (3) 2 (4) zero

NEET-I 2016

21. From a disc of radius R and mass M, a circular hole of diameter R, whose rim passes through the centre is cut. What is the moment of inertia of the remaining part of the disc about a perpendicular axis, passing through the centre ?

(1) 15 MR^2/32 (2) 13 MR^2/32

(3) 11 MR^2/32 (4) 9 MR^2/32

22. A uniform circular disc of radius 50 cm at rest is free to turn about an axis which is perpendicular to its plane and passes through its centre. It is subjected to a torque which produces a constant angular acceleration of 2.0 rad/s^2. Its net acceleration in m/s^2 at the end of 2.0 s is approximately :

(1) 8.0 (2) 7.0 (3) 6.0 (4) 3.0

23. A disc and a sphere of same radius but different masses roll off on two inclined planes of the same altitude and length. Which one of the two objects gets to the bottom of the plane first ?

(1) Disk

(2) Sphere

(3) Both reach at the same time

(4) Depends on their masses

NEET-II 2016

24. Two rotating bodies A and B of masses m and 2m with moments of inertia I_A and I_B ($I_B > I_A$) have equal kinetic energy of rotation. If L_A and L_B be their angular momenta respectively, then :-

(1) $L_B > L_A$ (2) $L_A > L_B$

(3) $L_A = \frac{L_B}{2}$ (4) $L_A = 2L_B$

25. A solid sphere of mass m and radius R is rotating about its diameter. A solid cylinder of the same mass and same radius is also rotating about its geometrical axis with an angular speed twice that of the sphere. The ratio of their kinetic energies of rotation (E_{sphere} / $E_{cylinder}$) will be :-

(1) 1 : 4 (2) 3 : 1

(3) 2 : 3 (4) 1 : 5

26. A light rod of length ℓ has two masses m_1 and m_2 attached to its two ends. The moment of inertia of the system about an axis perpendicular to the rod and passing through the centre of mass is :-

(1) $(m_1 + m_2)\ell^2$ (2) $\sqrt{m_1 m_2}\,\ell^2$

(3) $\frac{m_1 m_2}{m_1 + m_2}\ell^2$ (4) $\frac{m_1 + m_2}{m_1 m_2}\ell^2$

NEET(UG) 2017

27. A rope is wound around a hollow cylinder of mass 3 kg and radius 40 cm. What is the angular acceleration of the cylinder if the rope is pulled with a force of 30 N ?

(1) 0.25 rad/s^2 (2) 25 rad/s^2
(3) 5 m/s^2 (4) 25 m/s^2

28. Two discs of same moment of inertia rotating about their regular axis passing through centre and perpendicular to the plane of disc with angular velocities ω_1 and ω_2. They are brought into contact face to face coinciding the axis of rotation. The expression for loss of energy during this process is:-

(1) $\frac{1}{4}I(\omega_1-\omega_2)^2$ (2) $I(\omega_1-\omega_2)^2$

(3) $\frac{I}{8}(\omega_1-\omega_2)^2$ (4) $\frac{1}{2}I(\omega_1+\omega_2)^2$

29. Which of the following statements are **correct** ?

(a) Centre of mass of a body always coincides with the centre of gravity of the body
(b) Centre of mass of a body is the point at which the total gravitational torque on the body is zero
(c) A couple on a body produce both translational and rotation motion in a body
(d) Mechanical advantage greater than one means that small effort can be used to lift a large load

(1) (a) and (b) (2) (b) and (c)
(3) (c) and (d) (4) (b) and (d)

NEET (UG) 2018

30. Three objects, A : (a solid sphere), B : (a thin circular disk) and C = (a circular ring), each have the same mass M and radius R. They all spin with the same angular speed ω about their own symmetry axes. The amounts of work (W) required to bring them to rest, would satisfy the relation :-

(1) $W_C > W_B > W_A$ (2) $W_A > W_B > W_C$
(3) $W_B > W_A > W_C$ (4) $W_A > W_C > W_B$

31. The moment of the force, $\vec{F}=4\hat{i}+5\hat{j}-6\hat{k}$ at (2, 0, –3), about the point (2, –2, –2), is given by:-

(1) $-8\hat{i}-4\hat{j}-7\hat{k}$ (2) $-4\hat{i}-\hat{j}-8\hat{k}$
(3) $-7\hat{i}-8\hat{j}-4\hat{k}$ (4) $-7\hat{i}-4\hat{j}-8\hat{k}$

32. A solid sphere is in rolling motion. In rolling motion a body possesses translational kinetic energy (K_t) as well as rotational kinetic energy (K_r) simultaneously. The ratio $K_t : (K_t + K_r)$ for the sphere is

(1) 7 : 10 (2) 5 : 7 (3) 10 : 7 (4) 2 : 5

33. A solid sphere is rotating freely about its symmetry axis in free space. The radius of the sphere is increased keeping its mass same. Which of the following physical quantities would remain constant for the sphere ?

(1) Angular velocity
(2) Moment of inertia
(3) Rotational kinetic energy
(4) Angular momentum

NEET(UG) 2019

34. A disc of radius 2m and mass 100 kg rolls on a horizontal floor. Its centre of mass has speed of 20 cm/s. How much work is needed to stop it ?

(1) 3J (2) 30 kJ (3) 2 J (4) 1 J

35. A solid cylinder of mass 2 kg and radius 4 cm is rotating about its axis at the rate of 3 rpm. The torque required to stop after 2π revolutions is :

(1) 2×10^{-6} N m (2) 2×10^{-3} N m
(3) 12×10^{-4} N m (4) 2×10^{6} N m

NEET(UG) 2019 (Odisha)

36. A solid cylinder of mass 2 kg and radius 50 cm rolls up an inclined plane of angle inclination 30°. The centre of mass of cylinder has speed of 4 m/s. The distance travelled by the cylinder on the incline surface will be : (Take g = 10 m/s^2)

(1) 2.2 m (2) 1.6 m
(3) 1.2 m (4) 2.4 m

NEET(UG) 2020

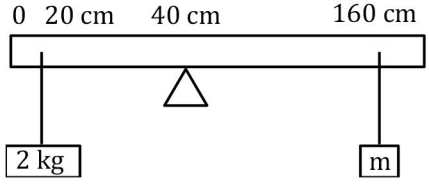
37. Find the torque about the origin when a force of $3\hat{j}$ N acts on a particle whose position vector is $2\hat{k}$ m :

(1) $6\hat{k}$ Nm (2) $6\hat{i}$ Nm

(3) $6\hat{j}$ Nm (4) $-6\hat{i}$ Nm

NEET(UG) 2021

38. A uniform rod of length 200 cm and mass 500 g is balanced on a wedge placed at 40 cm mark. A mass of 2 kg is suspended from the rod at 20 cm and another unknown mass 'm' is suspended from the rod at 160 cm mark as shown in the figure. Find the value of 'm' such that the rod is in equilibrium. ($g = 10\ m/s^2$)



(1) $\frac{1}{2}$kg (2) $\frac{1}{3}$kg

(3) $\frac{1}{6}$kg (4) $\frac{1}{12}$kg

39. From a circular ring of mass 'M' and radius 'R' an arc corresponding to a 90° sector is removed. The moment of inertia of the remaining part of the ring about an axis passing through the centre of the ring and perpendicular to the plane of the ring is 'K' times 'MR^2'. Then the value of 'K' is :

(1) $\frac{3}{4}$ (2) $\frac{7}{8}$ (3) $\frac{1}{4}$ (4) $\frac{1}{8}$

NEET(UG) 2022

40. The ratio of the radius of gyration of a thin uniform disc about an axis passing through its centre and normal to its plane to the radius of gyration of the dis about its diameter is :

(1) $\sqrt{2}:1$ (2) $4:1$ (3) $1:\sqrt{2}$ (4) $2:1$

RE-NEET(UG) 2022

41. An energy of 484 J is spent in increasing the speed of a flywheel from 60 rpm to 360 rpm. The moment of inertia of the flywheel is :

(1) 0.7 kg-m^2 (2) 3.22 kg-m^2

(3) 30.8 kg-m^2 (4) 0.07 kg-m^2

EXERCISE-II (Previous Year Questions) ANSWER KEY

Question	1	2	4	3	1	2	4	3	3	4	3	1	4	1	2
Answer	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Question	3	3	2	1	2	2	1	2	1	4	3	2	1	4	1
Answer	1	2	4	3	1	2	4	3	3	4	3	1	4	1	2
Question	31	32	33	34	35	36	37	38	39	40	41				
Answer	4	2	4	1	1	4	4	4	1	1	1				

1. Given below are two statements: One is labelled as **Assertion (A)** and the other is labelled as **Reason (R).**

Assertion (A) : Moment of inertia of a particle is a scalar quantity.

Reason (R) : Moment of inertia of a particle about any axis is given by $m(\vec{r}\cdot\vec{r})$ where m is mass of particle and $\vec{r}$ is position of particle w.r.t. axis.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.

(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.

(3) **(A)** is true but **(R)** is false.

(4) **(A)** is false but **(R)** is true.

2. Given below are two statements: One is labelled as **Assertion (A)** and the other is labelled as **Reason (R).**

Assertion (A) : Moment of inertia of a disc about an axis perpendicular to its plane passing through its centre is $\frac{mR^2}{2}$

Reason (R) : Moment of inertia of a disc about any axis passing through its plane remains equal.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.

(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.

(3) **(A)** is true but **(R)** is false.

(4) **(A)** is false but **(R)** is true.

3. Given below are two statements: One is labelled as **Assertion (A)** and the other is labelled as **Reason (R).**

Assertion (A) : In a conical pendulum angular momentum about its vertical axis remains constant

Reason (R) : Net torque about vertical axis of conical pendulum is not zero.

In the light of the above statements, choose the most appropriate answer from the options given below:

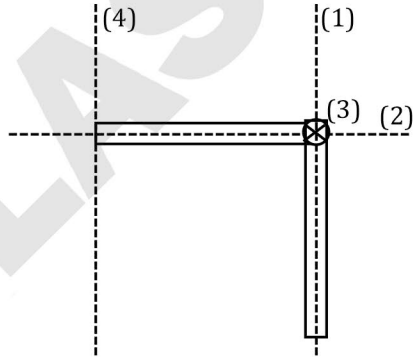
(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.

(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.

(3) **(A)** is true but **(R)** is false.

(4) **(A)** is false but **(R)** is true.

4. In diagram axis (3) is perpendicular to plane. Both rods are mass m and length 'ℓ' then moment of inertial of system



i	About axis (1)	P	$\frac{m\ell^2}{3}$
ii	About axis (2)	Q	$\frac{4m\ell^2}{3}$
iii	About axis (3)	R	$\frac{2m\ell^2}{3}$
iv	About axis (4)		

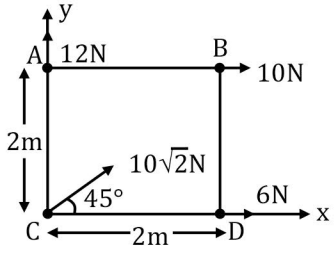
(1) i – P, ii – P, iii – R, iv – Q

(2) i – Q, ii – Q, iii – P, iv – R

(3) i – R, ii – R, iii – P, iv – Q

(4) i – P, ii – R, iii – Q, iv – P

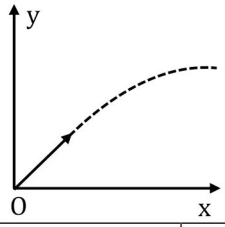
5. Value of net torque about given points.



i	Torque about A	P	$-64\hat{k}$
ii	Torque about B	Q	$32\hat{k}$
iii	Torque about C	R	$-12\hat{k}$
iv	Torque about D	S	$-20\hat{k}$

(1) i – P, ii – Q, iii – R, iv – S
(2) i – Q, ii – P, iii – P, iv – S
(3) i – Q, ii – R, iii – S, iv – P
(4) i – R, ii – S, iii – P, iv – S

6. A particle is projected from point 'O' having mass 'm' as shown in figure, moving on projectile path



i	Torque about 'O'	P	Zero
ii	Torque about x-axis	Q	Constant non zero
iii	Angular momentum about O	R	Increasing
iv	Angular momentum about x-axis	S	Decreasing

(1) i – P, ii – Q, iii – R, iv – S
(2) i – R, ii – P, iii – R, iv – P
(3) i – Q, ii – R, iii – R, iv – P
(4) i – P, ii – R, iii – R, iv – S

7. Four identical rods each of mass m and length 'ℓ' are joined to form a rigid square, centre is at origin and sides are parallel to x and y axis then moment of inertia about

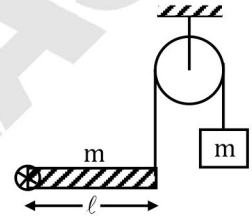
i	An axis parallel to z-axis and passing through a corner	P	$\frac{5}{3}m\ell^2$
ii	One side	Q	$\frac{2}{3}m\ell^2$
iii	The x-axis	R	$\frac{4}{3}m\ell^2$
iv	The z-axis passing through centre	S	$\frac{10}{3}m\ell^2$

(1) i – S, ii – P, iii – Q, iv – R
(2) i – P, ii – Q, iii – R, iv – S
(3) i – Q, ii – R, iii – p, iv – S
(4) i – S, ii – P, iii – R, iv – Q

8. A sphere is released on a smooth inclined plane. Its angular momentum is
(A) Conserved about every point
(B) Conserved about point of contact only
(C) Conserved about centre of sphere only
(D) Conserved about any point on a line parallel to inclined plane and passing through centre of ball.
From above, true statement/s is/are
(1) A, B, C (2) Only D
(3) C and D (4) Only C

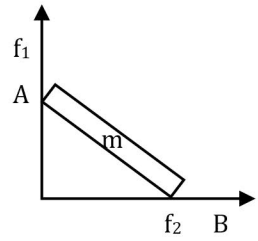
9. If lamina is in x-y plane then from theorem of perpendicular axis
(A) $I_x - I_y = I_z$ (B) $I_x - I_z = I_y$
(C) $I_x + I_y = I_z$ (D) $I_y + I_z = I_x$
True statements is/are –
(1) B and C (2) Only D
(3) Only C (4) C and D

10. Hinge is smooth and system is released from rest. Select correct statement –



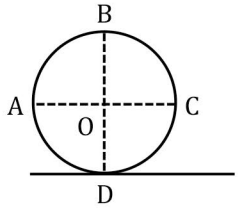
(A) Acceleration of block is g/2 down ward
(B) Acceleration of block is 3g/8 down ward
(C) Tension in string is mg/2
(D) Tension in string is 5mg/8
True statements is/are
(1) A, C (2) A, D (3) B, C (4) B, D

11. Wall and floor is rough. Rod is about to slide. Then find correct statement from the following
(Given f_1 and f_2 are friction forces)



(A) f_1 is in upward direction and f_2 towards the wall
(B) normal on B is less then mg
(C) normal on B is greater then mg
(D) normal on B is equal to mg
(1) A and B are true (2) A and C are true
(3) A and D are true (4) Only D is correct

12. A disc is rolling without friction then select correct statement from following –



(A) w.r.t. earth kinetic energy of upper half is more than lower half
(B) w.r.t. centre of disc K.E. of upper and lower half is same
(C) w.r.t. centre of disc K.E. of part AOD and BOC is same
(D) K.E. of parts of disc is independent of frame of reference

(1) A, B, C (2) A, B only
(3) D only (4) B, C only

EXERCISE-III (Analytical Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	
Answer	1	3	3	1	3	2	1	2	3	4	1	1	