NEET-UG

MECHANICS

MODULE-4

E-TECH ACADEMY

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INDEX

GRAVITATION

LEVEL-1

1. Newton's law of gravitation:

1) is not applicable outside the solar system

2) is used to govern the motion of satellites only

3) control the rotational motion of satellites and Planets

4) control the rotational motion of electrons in atoms

2. Mass particles of 1 kg each are placed along x-axis at x = 1, 2, 4, 8, …..∞. Then gravitational force on a mass of 3kg placed at origin is (G = universal gravitational constant) :-

1) 4G 2) 4G/3 3) 2G 4) ∞

3. The value of universal gravitational constant G depends upon :

1) Nature of material of two bodies

2) Heat constant of two bodies

3) Acceleration of two bodies

4) None of these

4. For elliptical orbits, in the equation $T^2 = \left(\frac{4\pi^2}{GM_s}\right)R^3$ **, R refers to…**

1) radius of orbit 2) major axis

3) semi-minor axis 4) semi-major axis

5. Kepler's second law may be stated as "under the influence of central force, in equal interval of time, position vector sweeps out equal

1) distance 2) area

3) displacement 4) volume

6. If the earth is at one-fourth of its present distance from the sun, the duration of the year will be

1) half the present year

2) one-eighth the present year

3) one-sixth the present year

4) one-tenth the present year

7. For a particle inside a uniform spherical shell, the gravitational force on the particle is

1) infinite 2) zero

3) $\frac{-Gm_1m_2}{r^2}$ 4) $\frac{Gm_1m_2}{r^2}$

8. Two spheres of masses in and M are situated in air and the gravitational force between them is F. The space around the masses is now filled with a liquid of specific gravity 3. The gravitational force will now be

1) F/9 2) 3F 3) F 4) F/3

9. Two identical spheres of gold arc in contact with each other. The gravitational attraction between them is

1) directly proportional to the square of the radius

2) directly proportional to the cube of the radius

3) directly proportional to the fourth power of the radius

4) inversely proportional to the square of the radius

10. Consider the following statements and select the correct statement(s)

I. Gravitational force may be attractive or repulsive.

II Gravitational force between two particles is independent of presence of other particles

III. Gravitational force is a short-range force

1) I only 2) II only3) II and III 4) I, II and III

11. Two bodies of masses 4 kg and 9 kg arc separated by a distance of 60 cm. A 1 kg mass is placed in between these two masses. If the net force on 1 kg is zero, then its distance from 4 kg mass is.

1) 26 cm 2) 30 cm 3) 28 cm 4) 24 cm

12. If three equal masses m are placed at the three vertices of an equilateral triangle of side Mm then what force acts on a particle of mass 2m placed at the centroid?

1) Gm^2 2) $2Gm^2$ 3) Zero 4) $-Gm^2$

13. Acceleration due to gravity at the centre of the earth is :-

1) g 2) g/2 3) zero 4) infinite

14. The value of 'g' on earth surface depends :-

1) only an earth's structure

2) only an earth's rotational motion

3) on above both

4) on none these and is same

15. The acceleration due to gravity g and mean density of earth ρ are related by which of the following relations? [G = gravitational constant and R = radius of earth] :

1) $\rho = \frac{4\pi gR^2}{3G}$ 2) $\rho = \frac{4\pi gR^3}{3G}$

3) $\rho = \frac{3g}{4\pi GR}$ 4) $\rho = \frac{3g}{4\pi GR^3}$

16. When you move from equator to pole, the value of acceleration due to gravity (g) :-

1) increases

2) decreases

3) remains the same

4) first increases then decreases

17. Acceleration due to gravity at earth's surface is 'g' m/s^2. Find the effective value of acceleration due to gravity at a height of 32 km from sea level: (Re = 6400 Km)

1) 0.5 g m/s^2 2) 0.99 g m/s^2

3) 1.01 g m/s^2 4) 0.90 g m/s^2

18. A body weighs 72 N on I he surface of the earth What is the gravitational force on it due to earth at a height equal to half the radius of the earth from the surface?

1) 32 N 2) 28 N 3) 16 N 4) 72 N

19. As we go down below the earth's surface, the accelerator due to gravity decreases by a factor (d → distance, R → radius of earth)

1) $1+\frac{d}{R}$ 2) $1-\frac{R}{d}$

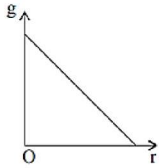
3) $1-\frac{d}{R}$ 4) remains constant

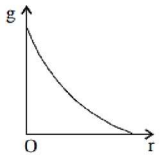
20. Which of the following is the correct relation between acceleration due to gravity 'g' and universal gravitational constant (G).

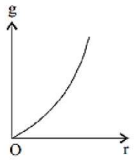
1) $g = \frac{G}{MR_E^2}$ 2) $g = \frac{GM_E}{R_E^2}$

3) g = G 4) $g = \frac{GM_E}{R_E}$

21. Which of the following graphs shows the correct variation of acceleration due to gravity with the height above the earth's surface?

1) 

2) 

3) 

4) None of these

22. Intensity of the gravitational field inside the hollow spherical shell is

1) variable 2) minimum

3) maximum 4) zero

23. In a gravitational field, at a point where the gravitational potential is zero

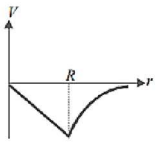
1) the gravitational field is necessarily zero

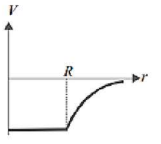
2) the gravitational field is not necessarily zero

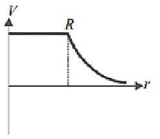
3) any value between one and infinite

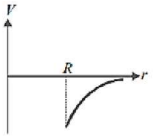
4) None of these

24. The gravitational potential due to a hollow sphere (mass M, radius R) varies with distance r from centre as

1) 

2) 

3) 

4) 

25. The gravitational potential at the centre of a square of side 'a' and four equal masses (m each) placed at the corners of a square is

1) Zero 2) $4\sqrt{2}\frac{Gm}{a}$ 3) $-4\sqrt{2}\frac{Gm}{a}$ 4) $-4\sqrt{2}\frac{Gm^2}{a}$

26. Potential energy of a 3kg body at the surface of a planet is - 54J, then escape velocity will be:

1) 18 m/s 2) 162 m/s

3) 36 m/s 4) 6 m/s

27. The ratio of radii of two satellites is p and the ratio of their acceleration due to gravity is q. The ratio of their escape velocities will be:

1) $\left(\frac{q}{p}\right)^{1/2}$ 2) $\left(\frac{p}{q}\right)^{1/2}$ 3) pq 4) $\sqrt{pq}$

28. Escape velocity of a body from earth is 11.2 km/s. Escape velocity, when thrown at an angle of 45° from horizontal will be :-

1) 11.2 km/s 2) 22.4 km/s

3) $11.2/\sqrt{2}$ km/s 4) $11.2\sqrt{2}$ km/s

29. Geo-stationary satellite is one which

1) remains stationary at a fixed height from the earth's surface

2) revolves like other satellites but in the opposite direction as earth's rotation.

3) revolves round the earth at a suitable height with same angular velocity and in the same angular velocity and in the same direction as earth docs about its own axis

4) None of these

30. A satellite of earth of mass 'm' is taken from orbital radius 2R to 3R, then minimum work done is :-

1) $\frac{GMm}{6R}$

2) $\frac{GMm}{12R}$

3) $\frac{GMm}{24R}$ 4) $\frac{GMm}{3R}$

31. Two identical satellites are at the heights R and 7R from the earth's surface. Then which of the following statement is incorrect :- (R = Radius of the earth)

1) Ratio of total energy of both is 5

2) Ratio of kinetic energy of both is 4

3) Ratio of potential energy of both 4

4) Ratio of total energy of both is 4

32. Near the earth's surface time period of a satellite is 1.4 hrs. Find its time period if it is at the distance '4R' from the centre of earth:

1) 32 hrs 2) $\left(\frac{1}{8\sqrt{2}}\right)$ hrs 3) $8\sqrt{2}$ hrs 4) 16 hrs

33. The earth revolves around the sun in one year. If distance between them becomes double, the new time period of revolution will be :-

1) 4-72 years 2) $2\sqrt{2}$ years

3) 4 years 4) 8 years

34. A satellite of mass m revolves in a circular orbit of radius R a round a planet of mass M. Its total energy E is :-

1) $-\frac{GMm}{2R}$ 2) $+\frac{GMm}{3R}$

3) $-\frac{GMm}{R}$ 4) $+\frac{GMm}{R}$

35. The escape velocity of a body depends upon mass as

1) m° 2) m^{1} 3) m^{2} 4) m^{3}

36. If V_e is escape speed from the earth and V_p is that from a planet of half the radius of earth, then

1) $V_e = V_p$ 2) $V_e = \frac{V_p}{2}$

3) $V_e = 2V_p$ 4) $V_e = \frac{V_p}{4}$

37. For a satellite moving in an orbit around the earth, the ratio of kinetic energy to potential energy is

1) $\frac{1}{2}$ 2) $\frac{1}{\sqrt{2}}$ 3) 2 4) $\sqrt{2}$

LEVEL-1 KEY

1	2	3	4	5	6	7	8	9	10
3	1	4	4	2	2	2	3	3	2
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
4	3	3	3	3	1	2	3	3	2
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
2	4	1	2	3	4	4	1	3	2
31	**32**	**33**	**34**	**35**	**36**	**37**			
1	3	2	1	1	3	1			

LEVEL-2

1. Four particles of masses m, 2m, 3m and 4m are kept in sequence at the corners of a square of side a. The magnitude of gravitational force acting on a particle of mass m placed at the centre of the square will be :

1) $\frac{24m^2G}{a^2}$ 2) $\frac{6m^2G}{a^2}$

3) $\frac{4\sqrt{2}m^2G}{a^2}$ 4) zero

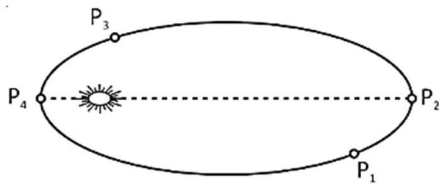
2. If the distance between the centres of earth and moon is D and mass of earth is 81 times that of moon. At what distance from the centre of earth gravitational field will be zero:

1) $\frac{D}{2}$ 2) $\frac{2D}{3}$ 3) $\frac{4D}{5}$ 4) $\frac{9D}{10}$

3. Three equal masses of 1 kg each are placed at the vertices of an equilateral triangle PQR and a mass of 2 kg is placed at the centroid O of the triangle which is at a distance of $\sqrt{2}$ m from each of the vertices of the triangle. The force, in newton, acting on the mass of 2 kg is :-

1) 2 2) $\sqrt{2}$ 3) 1 4) zero

4. The figure shows a planet in elliptical orbit around the sun S. Where is the kinetic energy of the planet maximum?



1) P_1 2) P_2 3) P_3 4) P_4

5. A planet goes round the sun three times as fast as the earth. If r_p and r_e are the radii of orbit of the planet and the earth respectively then

1) $r_e^3 = 8r_p^3$ 2) $r_e^3 = 3r_p^3$

3) $r_e^3 = 9r_p^3$ 4) $r_e^3 = \frac{1}{3}r_p^3$

6. If the distance of earth is halved from the sun, then the no. of days in a year will be

1) 365 2) 182.5 3) 730 4) 129

7. The height of the point vertically above the earth's surface, at which acceleration due to gravity becomes 1% of its value at the earth's surface is (Radius of the earth = R)

1) 8 R 2) 9R

3) 10 R 4) 20 R

8. The height at which the acceleration due to gravity g becomes $\frac{g}{9}$ (where g = the acceleration due to gravity on the surface of the earth) in terms of R, the radius of the earth, is

1) $\frac{R}{\sqrt{2}}$ 2) R / 2 3) $\sqrt{2}$R 4) 2 R

9. Imagine a new planet having the same density as that of earth but it is 3 times bigger than the earth in size. If the acceleration due to gravity on the surface of earth is g and that on the surface of the new planet is g', then

1) g' = g/9 2) g' - 27g

3) g'= 9g 4) g' = 3g

10. At what height from the ground will the value of g be the same as that in 10 km deep mine below the surface of earth?

1) 20 km 2) 10 km

3) 15 km 4) 5 km

11. The value of 'g' at a particular point is 9.8 m/s^2. Suppose the earth suddenly shrinks uniformly to half its present size without losing any mass. The value of 'g' at the same point (assuming that the distance of the point from the centre of the earth does not shrink) will now be

1) 4.9 m/sec^3 2) 3.1 m/sec^2

3) 9.8 m/sec^2 4) 19.6 in/sec^2

12. If a person goes to height equal to the radius of the earth, from its surface, then his weight (W') relative to the weight on earth (W) will be

1) $W' = \frac{W}{4}$ 2) $W' = 2W$

3) $W' = \frac{W}{2}$ 4) $W' = W$

13. If value of acceleration due to gravity is 'g° at a height 50 km above the surface of earth, then at what depth inside the earth will the acceleration due to gravity be same as 'g'?

1) 100km 2) 50km

3) 25km 4) 75km

14. The value of 'g' reduces to half of its value at surface of earth at a height 'h', then :-

1) h = R 2) h = 2R

3) $h = \left(\sqrt{2}+1\right)R$ 4) $h = \left(\sqrt{2}-1\right)R$

15. The mass of the moon is 1% of mass of the earth. The ratio of gravitational pull of earth on moon to that of moon on earth will be:

1) 1:1 2) 1 : 10 3) 1 : 100 4) 2 : 1

16. A body weighs W newton at the surface of the earth. Its weight at a height equal to half the radius of the earth will be:

1) $\frac{W}{2}$ 2) $\frac{2W}{3}$ 3) $\frac{4W}{9}$ 4) $\frac{W}{4}$

17. If M is the mass of earth and M is the mass of moon ($M_e = 81\ M_m$). The potential energy of an object of mass m situated at a distance R from the centre of earth and r from the centre of moon, will be:

1) $-GmM_m\left(\frac{R}{81}+r\right)\frac{1}{R^2}$ 2) $-GmM_e\left(\frac{81}{R}+\frac{1}{r}\right)$

3) $-GmM_m\left(\frac{81}{R}+\frac{1}{r}\right)$ 4) $GmM_m\left(\frac{81}{R}-\frac{1}{r}\right)$

18. The gravitational potential energy is maximum at:

1) infinity

2) the earth's surface

3) The centre of the earth

4) Twice the radius of the earth

19. A body attains a height equal to the radius of the earth when projected from earth' surface. The velocity of the body with which it was projected

1) $\sqrt{\frac{GM}{R}}$ 2) $\sqrt{\frac{2GM}{R}}$ 3) $\sqrt{\frac{5}{4}\frac{GM}{R}}$ 4) $\sqrt{\frac{3GM}{R}}$

20. An artificial satellite moving in a circular orbit around the earth has a total (kinetic + potential) energy Ey. Its potential energy is :-

1) $-E_0$ 2) E_0 3) $-2E_0$ 4) $2E_0$

21. Escape velocity of a 1kg body on a planet is 100 m/s. Potential energy of body at that planet is:

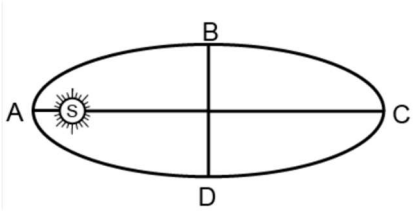
1) - 5000J 2) -1000J

3) -2400J 4) -10000J

22. Body is projected vertically upward from the surface of the earth with a velocity equal to half the escape velocity. If R is radius of the earth, the maximum height attained by the body is:

1) $\frac{R}{6}$ 2) $\frac{R}{3}$ 3) $\frac{2}{3}R$ 4) R

23. In adjoining figure earth goes around the sun in elliptical orbit on which point the orbital speed is maximum:



1) On A 2) On B

3) On C 4) On D

24. If a graph is plotted between T^2 and r^3 For a planet then its slope will be :-

1) $\frac{4\pi^2}{GM}$ 2) $\frac{GM}{4\pi^2}$ 3) $4\pi GM$ 4) zero

25. Geostationary satellite:

1) is situated at a great height above the surface of earth

2) moves in equatorial plane

3) have time period of 24 hours

4) have time period of 24 hours and moves in equatorial plane

26. Escape velocity for a projectile at earth's surface is V_e. A body is projected form earth's surface with velocity 2 V . The velocity of the body when it is at infinite distance from the centre of the earth is :-

1) V_e 2) $2\ V_e$ 3) $\sqrt{2}\ V_e$ 4) $\sqrt{3}\ V_e$

27. The orbital velocity of an artificial satellite in a circular orbit just above the earth's surface is v_0. The orbital velocity of satellite orbiting at an altitude of half of the radius is :-

1) $\frac{3}{2}v_0$ 2) $\frac{2}{3}v_0$ 3) $\sqrt{\frac{2}{3}}v_0$ 4) $\sqrt{\frac{3}{2}}v_0$

28. The mean distance of mars from sun is 1.5 times that of earth from sun. What is approximately the number of years required by mars to make one revolution about sun?

1) 2.35 years 2)1.85 years

3) 3.65 years 4) 2.75 years

29. A particle of mass M is situated at the centre of a spherical shell of same mass and radius a. The gravitational potential at a point situated at a/2 distance from the centre, will be:

1) $-\frac{3GM}{a}$ 2) $-\frac{2GM}{a}$

3) $-\frac{GM}{a}$ 4) $-\frac{4GM}{a}$

30. Assuming the radius of the earth as R, the change in gravitational potential energy of a body of mass m, when it is taken from the earth's surface to a height 3R above its surface, is

1) $3\,mgR$

2) $\frac{3}{4}mgR$

3) $1\ mgR$

4) $\frac{3}{2}mgR$

31. The gravitational potential energy associated with two particles separated by a distance r, when r is given by

1) $\frac{Gm_1m_2}{r}$

2) $\frac{-Gm_1m_2}{r}$

3) zero

4) infinity

32. On the surface of earth acceleration due to gravity is g and gravitational potential is V. Match the following:

	Column I		Column -II
(A)	At height $h = R$, value of g	(1)	decreases by a factor 1/4
(B)	At depth $h = R/2$, value of g	(2)	decreases by a factor 1/2
(C)	At height $h = R/2$, value of g	(3)	decreases by a factor 3/4
(D)	At depth $h = R/4$, value of g	(4)	decreases by a factor 2/3

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

2) (A)→(2); (B) → (2); (C) → (4); (D) → (3)

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

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

33. If g is the acceleration due to gravity on the earth's surface, the gain in P.E. of an object of mass m raised from the surface of the earth to a height of the radius R of the earth is

1) mgR 2) 2mgR

3) $\frac{1}{2}$mgR 4) $\frac{1}{4}$mgR

34. Let V and E denote the gravitational potential and gravitational field at a point. It is possible to have

1) V = 0 and E = 0 2) V = 0 and E ≠ 0

3) V≠ 0 and E = 0 4) All of the above

35. Assertion: The gain in potential energy of an object of mass m raised to height equal to the radius of earth is $\frac{1}{2}$mg R

Reason: Kinetic energy at surface = PE at the top $\frac{1}{2}mv^2$ and at the top $v = \sqrt{gR}$. ∴ PE= $\frac{1}{2}$mg R .

1) Assertion is correct, reason is correct; reason is a correct explanation for assertion.

2) Assertion is correct, reason is correct; reason is not a correct explanation for assertion

3) Assertion is correct, reason is incorrect

4) Assertion is incorrect, reason is correct.

36. The total energy of a circularly orbiting satellite is

1) twice the kinetic energy of the satellite

2) half the kinetic energy of the satellite

3) twice the potential energy of the satellite

4) half the potential energy of the satellite

37. If V_e is escape speed from the earth and V_p is that from a planet of half the radius of earth, then

1) $V_e = V_p$ 2) $V_e = \frac{V_p}{2}$

3) $V_e = 2V_p$ 4) $V_e = \frac{V_p}{4}$

38. The mass of a spaceship is 1000 kg It is to be launched from the earth's surface out into free space. The value of g and R (radius of earth) are 10 m/s^2 and 6400 km respectively. The required energy for this work will be

1) 6.4×10^{11}J 2) 6.4×10^{8} J

3) 6.4×10^{9} J 4) 6.4×10^{10} J

39. The moon has a mass of 1/81 that of the earth and a radius of 1 /4 that of the earth. The escape speed from the surface of the earth is 11.2 km/s. The escape speed from the surface of the moon is:

1) 1.25 km/s 2) 2.49 km/s

3) 3.7 km/s 4) 5.6 km/s

40. The escape velocity from the earth's surface is 11 km/s. The escape velocity from a planet having twice the radius and same mean density as that of earth is

1) 5.5 km/s 2) 11 km/s

3) 22 km/s 4) None of these

41. The radius of the earth is reduced by 4%. The mass of the earth remains unchanged. What will be the change in escape velocity?

1) Increased by 2% 2) Decreased by 4%

3) Increased by 6% 4) Decreased by 8%

LEVEL-2 KEY									
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
3	4	4	4	3	4	2	4	4	4
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
3	1	1	4	1	3	3	1	1	4
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
1	2	1	1	4	4	3	2	1	2
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
3	2	3	4	3	4	3	4	2	3
41									
1									

LEVEL-3(PREVIOUS YEARQUESTIONS)

1. Two satellites of earth, S_1 and S_2, are moving in the same orbit. The mass of S_1 is four times the mass of S_2. Which one of the following statements is true ? [AIPMT- 2007]

1) The kinetic energies of the two satellites are equal

2) The time period of S_1 is four times that of S_2

3) The potential energies of earth and satellite in the two cases are equal

4) S_1 and S_2 are moving with the same speed

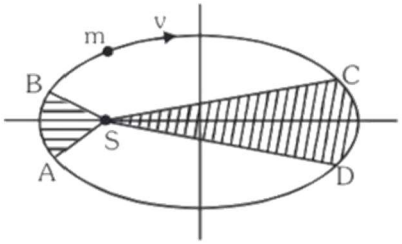
2. The figure shows elliptical orbit of a planet m about the sun S. The shaded area SCD is twice the shaded area SAB. If t_1 is the time for the planet to move from C to D and t_2 is the time to move from A to B then :- [AIPMT- 2009]

1) $t_1 = t_2$

2) $t_1 > t_2$

3) $t_1 = 4t_2$

4) $t_1 = 2t_2$



3. The radii of circular orbits of two satellites A and B of the earth, are 4R and R, respectively. If the speed of satellite A is 3V, then the speed of satellite B will be :- [AIPMT- 2010]

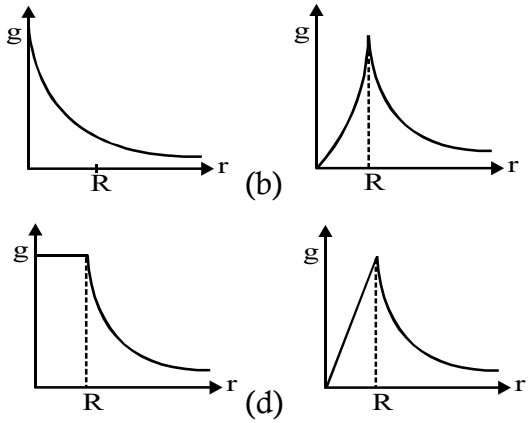
1) 3V/2 2) 3V/4 3) 6V 4) 12V

4. A particle of mass M is situated at the centre of a spherical shell of same mass and radius a. The gravitational potential at a point situated at $\frac{a}{2}$ distance from the centre, will be:[AIPMT- 2010]

1) $-\frac{4GM}{a}$ 2) $-\frac{3GM}{a}$

3) $-\frac{2GM}{a}$ 4) $-\frac{GM}{a}$

5. The dependence of acceleration due to gravity 'g' on the distance 'r' from the centre of the earth, assumed to be a sphere of radius R of uniform density, is as shown in figure below :- [AIPMT- 2010]



The correct figure is :-

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

6. The additional kinetic energy to be provided to a satellite of mass m revolving around a planet of mass M, to transfer it from a circular orbit of radius R_1 to another of radius $R_2 (R_2 > R_1)$ is :- [AIPMT- 2010]

1) $GmM\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$ 2) $2GmM\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$

3) $\frac{1}{2}GmM\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$ 4) $GmM\left(\frac{1}{R_1^2}-\frac{1}{R_2^2}\right)$

7. A planet moving along an elliptical orbit is closest to the sun at a distance r_1 and farthest away at a distance of r_2. If v_1 and v_2 are the linear velocities at these points respectively, then the ratio $\frac{v_1}{v_2}$ is :- [AIPMT- 2011]

1) $(r_1/r_2)^2$ 2) r_2/r_1

3) $(r_2/r_1)^2$ 4) r_1/r_2

8. A spherical planet has a mass M_p and diameter D_p. A particle of mass m falling freely near the surface of this planet will experience an acceleration due to gravity, equal to :- [AIPMT Pre.-2012]

1) GM_p/Dp^2 2) $4GM_pm/D_p^2$

3) $4GM_p/D_p^2$ 4) GM_pm/ D_p^2

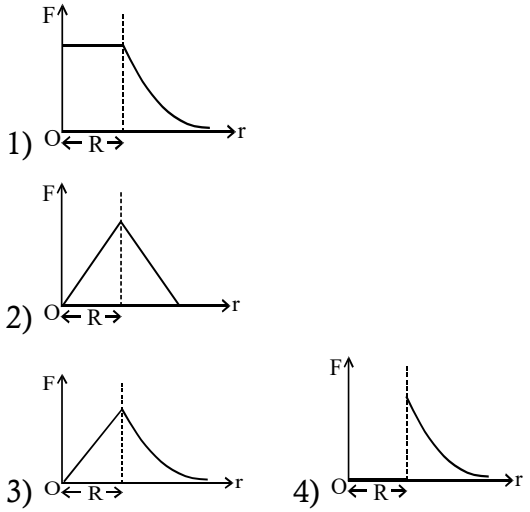
9. A geostationary satellite is orbiting the earth at a height of 5R above that surface of the earth, R being the radius of the earth. The time period of another satellite in hours at a height of 2R from the surface of the earth is :- [AIPMT Pre.-2012]

1) $6\sqrt{2}$ 2) $6/\sqrt{2}$ 3) 5 4) 10

10. The height at which the weight of a body becomes $1/16^{th}$, its weight on the surface of earth (radius R), is :-[AIPMT Pre.-2012]

1) 3R 2) 4R 3) 5R 4) 15R

11. Which one of the following plots represents the variation of gravitational field on a particle with distance r due to a thin spherical shell of radius R? (r is measured from the centre of the spherical shell) [AIPMT Mains-2012]



12. If v_e is escape velocity and v_0 is orbital velocity of a satellite for orbit close to the earth's surface, then these are related by : [AIPMT Mains-2012]

1) $v_e = \sqrt{2v_0}$ 2) $v_e = \sqrt{2}v_0$

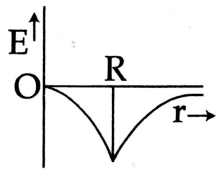
3) $v_0 = \sqrt{2}v_e$ 4) $v_0 = v_e$

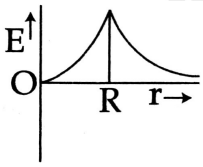
13. A black hole is an object whose gravitational field is so strong that even light cannot escape from it. To what approximate radius would earth (mass = 5.98×10^{24} kg) have to be compressed to be a black hole?

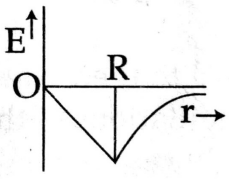
1) 10^{-2} m 2) 100m

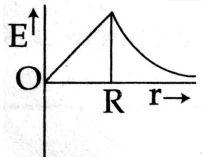
3) 10^{-9} m 4) 10^{-6} m **[AIMPT 2014]**

14. Dependence of intensity of gravitational field (E) of earth with distance (r) from centre of earth is correctly represented by : [AIMPT 2014]

1) 

2) 

3) 

4) 

15. Kepler's third law states that square of period of revolution (T) of a planet around the sun, is proportional to third power of average distance r between sun and planet i.e. $T^2 = Kr^3$ here K is constant. [AIMPT 2015]

If the masses of sun and planet are M and m respectively then as per Newton's law of gravitation force of attraction between them is $F = \frac{GMm}{r^2}$, here G is gravitational constant . The relation between G and K is described as:

1) $GMK = 4\pi^2$ 2) K = G

3) $K = \frac{1}{G}$ 4) $GK = 4\pi^2$

16. A satellite S is moving in an elliptical orbit around the earth. The mass of the satellite is very small compared to the mass of the earth : Re-AIPMT 2015

1) The acceleration of S is always directed towards the centre of the earth

2) The angular momentum of S about the centre of the earth changes in direction, but its magnitude remains constant

3) The total mechanical energy of S varies periodically with time

4) The linear momentum of S remains constant in magnitude.

17. A remote - sensing satellite of earth revolves in a circular orbit at a height of 0.25×10^6 m above the surface of earth. If earth's radius is 6.38×10^6 m and g = 9.8 ms^{-2}, then the orbital speed of the satellite is : [AIPMT-2015]

1) 8.56 km s^{-1} 2) 9.13 km s^{-1}

3) 6.67 km s^{-1} 4) 7.76 km s^{-1}

18. At what height from the surface of earth the gravitational potential and the value of g are -5.4×10^7 J kg^{-2} and 6.0 ms^{-2} respectively ? Take the radius of earth as 6400 km.[AIPMT_2016]

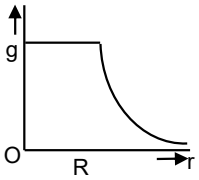
1) 2000 km 2) 2600 km

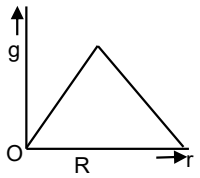
3) 1600 km 4) 1400 km

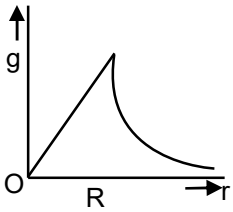
19. The ratio of escape velocity at earth (v_e) to the escape velocity at a planet (v_p) whose radius and mean density are twice as that of earth is : [AIPMT-2016]

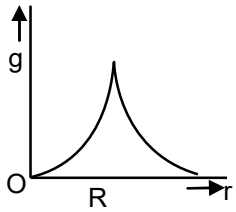
1) 1 : $\sqrt{2}$ 2) 1 : 2 3) 1 : $2\sqrt{2}$ 4) 1 : 4

20. Starting from the centre of the earth having radius r, the variation of g (acceleration due to gravity) is shown by [NEET 2016-17]

1) 

2) 

3) 

4) 

21. A satellite of mass m is orbiting the earth (of radius R) at a height h from its surface. The total energy of the satellite in terms of g_0, the value of acceleration due to gravity at the earth's surface, is [NEET 2017]

1) $-\frac{2mg_0R^2}{R+h}$ 2) $\frac{mg_0R^2}{2(R+h)}$

3) $-\frac{mg_0R^2}{2(R+h)}$ 4) $\frac{Rmg_0R^2}{R+h}$

22. The acceleration due to gravity at a height 1 km above the earth is the same as at a depth d below the surface of earth. Then :- [NEET-2017]

1) d = 1 km 2) $d=\frac{3}{2}$ km

3) d = 2 km 4) $d=\frac{1}{2}$ km

23. Two astronauts are floating in gravitational free space after having lost contact with their spaceship. The two will : [NEET-2017]

1) keep floating at the same distance between them

2) move towards each other

3) move away from each other

4) will become stationary

24. If the mass of the Sun were ten times smaller and the universal gravitational constant were ten times larger in magnitude, which of the following is not correct? [NEET 2018]

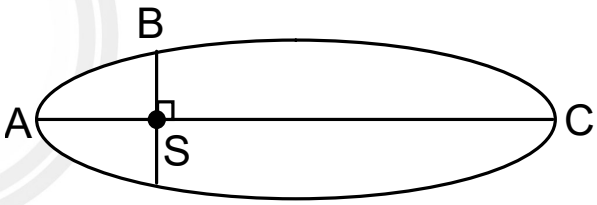
1) Raindrops will fall faster.

2) 'g' on the Earth will not change

3) Time period of a simple pendulum on the Earth would decrease.

4) Walking on the ground would become more difficult.

25. The kinetic energies of a planet in an elliptical orbit about the Sun, at positions A, B and C are K_A, K_B and K_C, respectively. AC is the major axis and SB is perpendicular to AB at the position of the Sun S as shown in the figure. Then [NEET 2018]



1) $K_A < K_B < K_C$ 2) $K_B > K_A > K_C$

3) $K_B < K_A < K_C$ 4) $K_A > K_B > K_C$

26. Two bodies of mass m and 9m are placed at a distance R. The gravitational potential on the line joining the bodies where the gravitational field equals zero, will be: (G- gravitational constant)

1) $-\frac{20GM}{R}$

2) $-\frac{8GM}{R}$

3) $-\frac{12GM}{R}$ 4) $-\frac{16GM}{R}$

27. The work done to raise a mass m from the surface of the earth to a height h, which is equal to the radius of the earth, is:

1) $\frac{3}{2}$ mgR 2) mgR **[NEET-2019]**

3) 2mgR 4) $\frac{1}{2}$ mgR

28. A body weighs 200 N on the surface of the earth. How much will it weigh halfway down the centre of the earth? [NEET-2019]

1) 100 N 2) 150 N

3) 200 N 4) 250 N

29. The time period of a geostationary satellite is 24 h at a height $6R_E$ (R_E is the radius of the earth) from the surface of the earth. The time period of another satellite whose height is 2.5 R_E from the surface, will be: [NEET-2019]

1) $6\sqrt{2}$h 2) $12\sqrt{2}$h 3) $\frac{24}{2.5}$h 4) $\frac{12}{2.5}$h

30. A body weighs 72 N on the surface of the earth. What is the gravitational force on it at a height equal to half the radius of the earth? [NEET-2020]

1) 32 N 2) 30 N 3) 24 N 4) 48 N

31. The escape velocity from the Earth's surface is v. The escape velocity from the surface of another planet having a radius, four times that of Earth and same mass density is:[NEET-2021]

1) 3v 2) 4v 3) v 4) 2v

32. A body of mass 60 g experiences a gravitational force of 3.0 N when placed at a particular point. The magnitude of the gravitational field intensity at that point is: [NEET-2022]

1) 180 N/kg 2) 0.05 N/kg

3) 50 N/kg 4) 20 N/kg

33. A satellite is orbiting just above the surface of the earth with period T. If d is the density of the earth and G is the universal constant of gravitation, the quantity $\frac{3\pi}{Gd}$ represents: [NEET-2023]

1) $\sqrt{T}$ 2) T 3) T^2 4) T^3

LEVEL-3 KEY

1	2	3	4	5	6	7	8	9	10
4	4	3	2	4	3	2	3	1	1
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
4	2	1	3	1	1	4	2	3	3
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
3	3	2	2	4	4	4	1	1	1
31	**32**	**33**							
2	3	3							

ELASTICITY

LEVEL-1

1. The lower surface of a cube is fixed. On its upper surface, force is applied at an angle of 30° from its surface. The change will be in its

1) shape 2) size

3) volume 4) Both shape and size

2. A metallic cube whose each side is 10 cm is subjected to a shearing force of 100 kgf. Calculate the shearing stress produced.

1) $9.8 \times 10^4\ Nm^{-2}$ 2) $10 Nm^{-2}$

3) $9.8\ Nm^{-2}$ 4) $9.8 \times 10^2\ Nm^{-2}$

3. A cube is subjected to a uniform volume compression. If the side of the cube decreases by 2%, the bulk strain is

1) 0.02 2) 0.03

3) 0.04 4) 0.06

4. A metallic cube of side 10 cm is subjected to a shearing force of 300 kgf. The top face is displaced through 0.25 cm with respect to the bottom? Calculate the shearing strain produced.

1) 0.25 2) 2.5

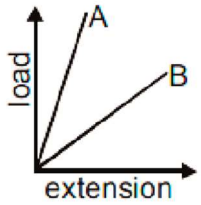
3) 0.025 4) 0.08

5. For steel, the breaking stress is $6 \times 10^6\ N/m^2$ and the density is $8 \times 10^3\ kg/m^3$. The maximum length of steel wire, which can be suspended without breaking under its own weight is [$g = 10\ m/s^2$]

1) 140 m 2) 120 m

3) 75 m 4) 200 m

6. The dimensions of two wires A and B are the same. But their materials are different. Their load-extension graphs are shown. If Y_A and Y_B are the values of Young's modulus of elasticity of A and B respectively then



1) $Y_A > Y_B$ 2) $Y_A < Y_B$

3) $Y_A = Y_B$ 4) $Y_B = 2Y_A$

7. A fixed volume of iron is drawn into a wire of length ℓ. The extension produced in this wire by a constant force F is proportional to –

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

8. The Young's modulus of a rubber string 8 cm long and density 1.5 kg/m^3 is $5 \times 10^8\ N/m^2$, is suspended on the ceiling in a room. The increase in length due to its own weight will be:

1) 9.6×10^{-5} m 2) 9.6×10^{-11}m

3) 9.6×10^{-3}m 4) 9.6 m

9. According to Hooke's law of elasticity, if stress is increased, then the ratio of stress to strain

1) becomes zero 2) remains constant

3) decreases 4) increases

10. For an equal stretching force F, the young's modulus (Y_S). for steel and rubber (Y_R) are related as

1) $Y_S = Y_R$ 2) $Y_S < Y_R$

3) $Y_S > Y_R$ 4) $Y_S \geq Y_R$

11. The expression of force constant for a spring following Hooke's law is given by

1) $k = \frac{YA}{\ell}$ 2) $k = \frac{YA}{\Delta\ell}$

3) $k = \frac{YA\Delta\ell}{\ell}$ 4) $k = \frac{YA\ell}{\Delta\ell}$

12. A 2 m long rod of radius 1 cm which is fixed from one end is given a force of 8N The longitudinal strain developed will be [take $\gamma = 2.5 \times 10^{11}\ N/m^2$]

1) 10^{-8} 2) 10^{-6} 3) 10^{-5} 4) 10^{-4}

13. The restoring force per unit area is known as

1) Strain 2) elasticity

3) Stress 4) plasticity

14. Which of the following affects the elasticity of a substance?

1) Hammering and annealing

2) Change in temperature

3) Impurity in substance

4) All of the above

15. An increases in pressure required to decreases the 200 litres volume of a liquid by 0.004% in container is : (Bulk modulus of the liquid = 2100 MPa)

1) 188 kPa 2) 8.4 kPa

3) 18.8 kPa 4) 84 kPa

16. A rubber cord 10 m is suspended vertically. How much does it stretch under its own weight? (Density of rubber is 1500 kg m^{-3}, Y = 5 × 10^8 Nm^{-2} and g = 10 ms^{-2})

1) 15×10^{-4} m 2) 7.5×10^4 m

3) 12×10^{-4} m 4) 25×10^{-4} m

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

1) Young's modulus for a perfectly rigid body is zero.

2) Bulk modulus is relevant for solids, liquids and gases.

3) Rubber is less elastic than steel.

4) The Young's modulus and shear modulus are relevant for solids.

18. A mass of 0.5 kg is suspended from wire, then length of wire increase by 3 mm then find out work done:

1) 4.5×10^{-3} J 2) 7.3×10^{-3} J

3) 9.3×10^{-2} J 4) 2.5×10^{-2} J

19. The ratio of shearing stress to the corresponding shearing strain is called

1) hulk modulus

2) Young's modulus

3) modulus of rigidity

4) None of these

20. The reciprocal of the bulk modulus is called

1) modulus of rigidity

2) volume stress

3) volume strain

4) compressibility

21. A metallic wire of length 2.0 m is elongated by 2.0 mm. Area of cross-section of the wire is 4.0 mm2. The elastic potential energy stored in the wire in elongated condition is [young's modulus of the metallic wire is = $2 \times 10^{11}\ Nm^2$]

1) 8.23 2) 0.83 3) 6 23 4) 0 63

22. Assertion: Bulk modulus of elasticity (k) represents incompressibility of the material. **Reason:** Bulk modulus of elasticity is proportional to change in pressure.

1) Assertion is correct, reason is correct; reason is a correct explanation for assertion.

2) Assertion is correct, reason is correct; reason is not a correct explanation for assertion

3) Assertion is correct, reason is incorrect

4) Assertion is incorrect, reason is correct

23. Modulus of rigidity of ideal liquids is

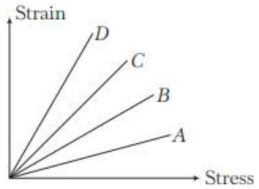
1) infinity

2) zero

3) unity

4) some finite small non-zero constant value

24. Stress-strain curve for four metals are shown in figure. The maximum Young's modulus of elasticity for metal, is



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

25. When a load of 10 kg is hung from the wire, then extension of 2 m is produced. Then, work done by restoring force is

1) 200 J 2) 100J 3) 50 J 4) 25 J

26. Match the following columns and choose the correct option from the codes given below.

	Column I	**Column II**
(A)	Longitudinal stress_	(p) volume changes_
(B)	Shear stress_	(q) shape changes_
(C)	Volumetric stress_	(r) volume does not changes
(D)	Tensile stress_	(s) shapes dues not change

Codes

	A	B	C	D
1)	p,s	q,r	p,s	p,s
2)	q,r	p,s	p,s	p,s
3)	p,s	p,s	q,r	p,s
4)	p,s	p,s	p,s	q,r

27. Match the following columns and choose the correct option from the codes given below.

	Column I	**Column II**
(A)	Stress X Strain	(p) J
(B)	YA/l	(q) Nm^{-1}
(C)	Yl^3	(r) Jm^3
(D)	Fl/AY	(s) m

	A	B	C	D
1)	r	q	p	s
2)	q	r	p	s
3)	p	s	r	q
4)	q	i	s	p

LEVEL-1 KEY

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
4	1	4	3	3	1	3	2	2	3
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
1	2	3	4	4	1	1	2	3	4
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
2	1	2	1	2	1	1			
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**		

LEVEL-2

1. A wire elongates by ℓ mm when a load W is hanged from it. If the wire goes over a pulley and two weights W each are hung at the two ends, the elongation of the wire will be (in mm)

1) $\ell/2$ 2) ℓ 3) 2ℓ 4) zero

2. The pressure of a medium is changed from 1.01 × 10^5 *Pa* to 1.165 × 10^5 *Pa* and change in volume is 10% keeping temperature constant. The Bulk modulus of the medium is

1) 204.8 × 10^5 *Pa* 2) 102.4 × 10^5 *Pa*

3) 51.2 × 10^5 *Pa* 4) 1.55 × 10^5 *Pa*

3. Two wires of the same material and length but diameter in the ratio 1 : 2 are stretched by the same force. The ratio of potential energy per unit volume for the two wires when stretched will be:

1) 1 : 1 2) 2 : 1 3) 4 : 1 4) 16 : 1

4. If the interatomic spacing in a steel wire is 2.8 × 10^{-10} m and Y_{steel} = 2 × 10^{11} N/m^2, then force constant in N/m is –

1) 5.6 2) 56 3) 0.56 4) 560

5. Cross section area of a steel wire (Y = 2.0 × 10^{11} N/m^2) is 0.1 cm^2. The required force, to make its length double will be –

1) 2 × 10^{12}N 2) 2 × 10^{11}N

3) 2 × 10^{10} N 4) 2 × 10^6N

6. The diameter of a brass rod is 4 mm and Young's modulus of brass is 9 × 10^{10} N/m^2. The force required to stretch by 0.1% of its length is :

1) 360 πN 2) 36 N

3) 144 π× 10^3 N 4) 36 π× 10^5 N

7. If 'S' is stress and 'Y' is Young's modulus of material of a wire, the energy stored in the wire per unit volume is :

1) $2S^2Y$ 2) $\frac{S^2}{2Y}$ 3) $\frac{2Y}{S^2}$ 4) $\frac{S}{2Y}$

8. For a constant hydraulic stress on an object, the fractional change in the object's volume $\left(\frac{\Delta V}{V}\right)$ and its bulk modulus (*B*) are related as

1) $\frac{\Delta V}{V} \propto B$ 2) $\frac{\Delta V}{V} \propto \frac{1}{B}$

3) $\frac{\Delta V}{V} \propto B^2$ 4) $\frac{\Delta V}{V} \propto B^{-2}$

9. A wire of length *L* and cross-sectional area *A* is made of a material of Young's modulus *Y*. The work done in stretching the wire by an amount *x*. is given by

1) $\frac{YAx}{2L}$ 2) $\frac{YAx^2}{L}$ 3) $\frac{YAx^2}{2L}$ 4) $\frac{2YAx^2}{L}$

10. When a spiral spring is stretched by force, strain produced in?

1) longitudinal strain 2) volumetric strain

3) shear strain 4) Both (a) and (c)

11. A wire of length 2.5 m has a percentage strain of 0.012% under a tensile force. The extension produced in the wire will be

1) 0.03 mm 2) 0.3 mm

3) 0.3m 4) 0.03 in

12. Two similar wires under the same load yield elongation of 0.1 mm and 0.05 mm, respectively. If the area of cross-section of the first wire is 4 mm^2, then the area of cross-section of the second wire is

1) 6 mm^2

2) 8mm^2

3) 10mm^2 4)12mm^2

13. Choose the incorrect statement

1) The bulk modulus for solids is much larger than for liquids.

2) Gases are least compressible

3) The incompressibility of the solids is due to the tight

4) The reciprocal of the bulk modulus is called compressibility.

14. A metallic rod of length *l* and cross-sectional area A is made of a material of Young's modulus Y. If the rod is elongated by an amount y, then the work done is proportional to

1) y 2) $1/y$ 3) y^2 4) $1/y^2$

15. A wire suspended vertically from one of its ends is stretched by attaching a weight of 200 N to the lower end. The weight stretches the wire by 1 mm. Then, the energy stored in the

1) 0.1 J 2) 0.2 J 3) 10 J 4) 20 J

16. Wires A and B are made from the same material. A has twice the diameter and three times the length of B. If the elastic limits are not reached, when each is stretched by the same tension, the ratio of energy stored in A to that in B is

1) 2 : 3 2) 3 : 4 3) 3 : 2 4) 6 : 1

17. When a force is applied on a wire of uniform cross-sectional area 3×10^{-6} m^2 and length 4m, the increase in length is 1 mm. Energy stored in it will be ($Y = 2 \times 10^{11}$ N / m^2)

1) 6250 J

2) 0.177 J

3) 0.075 J

4) 0.150 J

18. With regard to dependence of quantities given in Columns I and II, match the following columns and choose the correct option from the codes given below.

	Column I		Column II
(A)	Young's modulus of a substance	(p)	depends on temperature
(B)	Bulk modulus of a substance	(q)	depends on length
(C)	Modulus of rigidity of a substance	(r)	depends on area of cross-section
(D)	Volume of a substance	(s)	depends on the nature of material

Codes

	A	B	C	D
1)	p,s	q,s	p,s	p,q
2)	p,s	p,s	p,s	p.q
3)	p,s	p,s	p,s	p,q,r
4)	p,q,r	p,s	p,s	p,r

19. which of the following is correct for young's modulus of elasticity (y)?

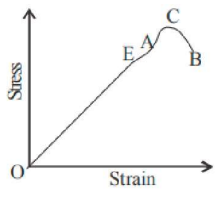
[where r = radius of cross section of wire]

***l* = length of wire**

1) $\gamma \propto r^2$ 2) $\gamma \propto r^3$

3) $\gamma \propto 1/r^2$ 4) $\gamma \propto l^2$

20. For the given graph, Hooke's law is obeyed in the region



1) OA 2) C 3) OE 4) OB

21. If the ratio of radii of two wires of same material is 3 : 1 and ratio of their lengths is 5 : 1, then the ratio of the normal forces that will produce the same extension in the length of two wires is

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

22. Two wires of equal lengths are made of the same material Wire A has a diameter that is twice as that of wire B. If identical weights are suspended from the ends of these wires, the increase in length is

1) four times for wire A as for wire B

2) twice for wire A as for wire B

3) half for wire A as for wire B

4) one-fourth for wire A as for wire B

23. A copper wire ($Y = 10^{11}$ N/m^2) of length 8 in and steel wire ($Y = 2 \times 10^{11}$ N/m^2) of length 4 m each of 0.5 cm^2 cross-section are fastened end to end and stretched with a tension of 500 N

	Column-I		Column-II
(A)	Elongation in copper wire in mm	(1)	0.25
(B)	Elongation in steel wire in mm	(2)	1.0
(C)	Total elongation in mm	(3)	0.8
(D)	Elastic potential energy of the system in joules	(4)	$\frac{1}{4}$th the elongation in copper wire

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

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

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

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

24. A metallic wire of length 2.0 m is elongated by 2.0 mm. Area of cross-section of the wire is 4.0 mm^2. The elastic potential energy stored in the wire in elongated condition is
[young's modulus of the metallic wire is = 2×10^{11} N/m^2]

1) 8.23 2) 0.83 3) 6.23 4) 0.63

25. Assertion : Identical springs of steel and copper are equally stretched. More work will be done on the steel

Reason: Steel is more elastic than copper.

1) Assertion is correct, reason is correct; reason is correct explanation for assertion.

2) Assertion is correct, reason is correct; reason is not a correct explanation for assertion.

3) Assertion is correct, reason is incorrect

4) Assertion is incorrect, reason is correct.

26. If in a wire of Young's modulus 7, longitudinal strain X is produced, then the value of potential energy stored in its unit volume will be

1) YX^2 2) $2YX^2$

3) $Y^2X/2$ 4) $YX^2/2$

27. Two steel wires having same length are suspended from a ceiling under the same load. If the ratio of their energy stored per unit volume is 1 : 4, the ratio of their diameters is:

1) $\sqrt{2}:1$ 2) 1 : 2

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

28. The maximum load, a wire can withstand without breaking, when its length is reduced to half of its original length, will

1) be double 2) be half

3) be four times 4) remain same

29. A metal block is experiencing an atmospheric pressure of 10^5 Nm^{-2}. When the same block is placed in a vacuum chamber, the fractional change in its volume, is (the bulk modulus of metal is 1.25×10^{11} Nm^{-2})

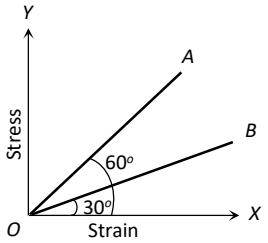
1) 4×10^{-7} 2) 2×10^{-7}

3) 8×10^{-7} 4) 1×10^{-7}

30. Two wires of same diameter of the same material having the length *l* and 2*l*. If the force F is applied on each, the ratio of the work done in the two wires will be

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

31. The stress versus strain graphs for wires of two materials *A* and *B* are as shown in the figure. If Y_A and Y_B are the Young 's moduli of the materials, then



1) $Y_B = 2Y_A$

2) $Y_A = Y_B$

3) $Y_B = 3Y_A$

4) $Y_A = 3Y_B$

32. A cable that can support a load w is cut into two equal parts. The maximum load that can be supported by either part is

1) w/4 2) w/2 3) w 4) 2w

33. A copper wire (Y = 10^{11} N/m^{-2}) of length 8 in and steel wire (Y = 2×10^{11} N/m^{-2}) of length 4 m each of 0.5 cm^2 cross-section are fastened end to end and stretched with a tension of 500 N

Choose the correct statement

1) Elongation in copper wire in 0.8 mm

2) Elongation in steel is $\frac{1}{4}$th the elongation in copper wire

3) Total elongation is 1.0 mm

4) All of the above

34. Which of the following statement(s) is/are correct?

I. Incompressible liquids have finite value of bulk modulus of elasticity

II. Compressibility is inverse of bulk modulus of elasticity

1) Only I 2) Only II

3) Both I and II 4) None of these

35. Which of the following statement(s) is/are correct?

I. The materials having low value of Young's modulus of elasticity are more ductile.

II. If Young's modulus is less, then they can be easily stretched as wires.

1) Only I 2) Only II

3) Both I and II 4) None of the above

LEVEL-2 KEY

1	2	3	4	5	6	7	8	9	10
2	4	4	2	4	1	2	2	3	4
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
2	2	2	3	1	2	3	3	3	3
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
4	4	1	2	1	4	1	4	3	1
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
4	3	3	2	3					

LEVEL-3

1. If 'S' is stress and 'Y' is Young's modulus of material of a wire, the energy stored in the wire per unit volume is : [AIEEE-2005]

1) $\frac{S}{2Y}$ 2) $\frac{2Y}{S^2}$ 3) $\frac{S^2}{2Y}$ 4) $2S^2Y$

2. The following four wires are made of same material and same tension is applied on them. Which one will have maximum increase in length ? [NEET UG 2013]

1) Length = 100 cm, Diameter = 1mm
2) Length = 50 cm, Diameter = 0.5 mm
3) Length = 200 cm, Diameter = 2mm
4) Length = 300 cm, Diameter = 3 mm

3. The Young's modulus of a rope of 10 m length and having diameter of 2 cm is 20×10^{11} dyne cm^{-2}. If the elongation produced in the rope is 1 cm, the force applied on the rope is [J&K CET 2013]

1) 6.28×10^5 N 2) 6.28×10^4 N
3) 6.28×10^4 dyne 4) 6.28×10^5 dyne

4. Copper of fixed volume 'V' is drawn into wire of length 'ℓ'. When this wire is subjected to a constant force 'F', the extension produced in the wire is '$\Delta\ell$'. Which of the following graph is a straight line? [AIPMT-2014]

1) $\Delta\ell$ versus $1/\ell$ 2) $\Delta\ell$ versus ℓ^2
3) $\Delta\ell$ versus $1/\ell^2$ 4) $\Delta\ell$ versus ℓ

5. A load of 4 kg is suspended from a ceiling through a steel wire of length 2 m and radius 2 mm. It is found that, the length of the wire increases by 0.031 mm as equilibrium is achieved. What would be the Young's modulus of steel? (Take, g = 3.1 π ms^{-2}) [UK PMT 2015]

1) 2.0×10^{11} Nm^{-2} 2) 2.82×10^{11} Nm^{-2}
3) 0.20×10^{11} Nm^{-2} 4) 0.028×10^{11} Nm^{-2}

6. The elastic potential energy of a stretched wire is given by [CG PMT 2015]

1) $U = \frac{AL}{2Y}l^2$ 2) $U = \frac{AY}{2L}l^2$

3) $U = \frac{1}{2}\left(\frac{ALl}{Y}\right)l$ 4) $U = \frac{1}{2}.\frac{YL}{2A}.l$

7. The bulk modulus of a spherical object is B. If it is subjected to uniform pressure p, the fractional decrease in radius is [NEET 2017]

1) $\frac{p}{B}$ 2) $\frac{B}{3p}$ 3) $\frac{3p}{B}$ 4) $\frac{p}{3B}$

8. Two wires are made of the same material and have the same volume. The first wire has cross-sectional area A and the second wire has cross-sectional area 3A. If the length of the first wire is increased by $\Delta\ell$ on applying a force F, how much force is needed to stretch the second wire by the same amount? [NEET-2018]

1) 9 F 2) F 3) 4 F 4) 6 F

9. When a block of mass M is suspended by a long wire of length L, the length of the wire becomes (L+ ℓ). The elastic potential energy stored in the extended wire is: [NEET 2019]

1) $\frac{1}{2}$MgL 2) MgL

3) MgL 4) $\frac{1}{2}$Mgℓ

10. The stress-strain curves are drawn for two different materials Xand Y. It is observed that, the ultimate strength point and the fracture point are close to each cither for material X but are far apart for material Y. We can say that, materials X and Y are likely to be (respectively) [NEET (Odisha 2019]

1) ductile and brittle 2) brittle and ductile

3) brittle and plastic 4) plastic and ductile.

11. A wire of length. L, area of cross-section A is hanging from a fixed support. The length of the wire changes to L_1 when mass M is suspended from its free end. The expression for Young's modulus is [NEET 2020]

1) $\frac{Mg(L_1 - L)}{AL}$ 2) $\frac{MgL}{AL_1}$

3) $\frac{MgL}{A(L_1 - L)}$ 4) $\frac{MgL_1}{AL}$

12. The amount of elastic potential energy per unit volume (in SI unit) of a steel wire of length 100 cm to stretch it by 1 mm is (if Young s modulus of the wire = $2.0 \times 10^{11} Nm^{-2}$): [NEET 2023]

1) 10^{11} 2) 10^{17}

3) 10^{7} 4) 10^{5}

13. Let a wire be suspended from the ceiling (rigid support) and stretched by a weight W attached at its free end. The longitudinal stress at any point of cross-sectional area A of the wire is:

1) Zero 2) 2W/A **NEET 2023]**

3) W/A 4) W/2A

			LEVEL-3 KEY						
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
2	2	2	2	1	2	4	1	4	2
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
3	4	3							

FLUID MECHANICS

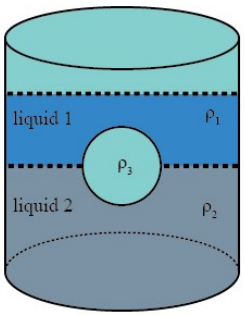
LEVEL-1

1. **Liquid pressure depends upon**
   1) area of the liquid surface
   2) shape of the liquid surface
   3) height of the liquid column
   4) directions

2. **Hydraulic lifts and hydraulic brakes are based on**
   1) Archimedes' principle
   2) Bernoulli's principle
   3) Stoke's law
   4) Pascal's law

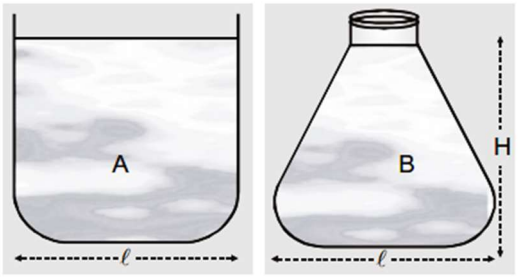
3. **_____and_____play the same role in ease of fluids as force and mass play in case of solids.**
   1) Thrust and density
   2) Pressure and density
   3) Pressure and thrust
   4) Thrust and volume

4. **Ajar is filled with two non-mixing liquids 1 and 2 having densities ρ_1 and ρ_2 respectively A solid ball, made of a material of density ρ_3, is dropped in the jar. It comes to equilibrium in the position shown in the figure Which of the following is true for ρ_1, ρ_2 and ρ_3?**



   1) $\rho_3 < \rho_1 < \rho_2$ 2) $\rho_1 > \rho_3 > \rho_2$
   3) $\rho_1 < \rho_2 < \rho_3$ 4) $\rho_1 < \rho_3 < \rho_2$

5. **Two vessels A and B have the same base area and contain water to the same height, but the mass of water in A is four times that in B. The ratio of the liquid thrust at the base of A to that at the base of B is:-**



   1) 4 : 1 2)2 : 1 3) 1 : 1 4) 16 : 1

6. **If the density of a block is 981 kg/m^3 then it shall**
   1) Sink in water
   2) float with some part immersed in water
   3) float completely immersed in watere
   4) float completely out of water.

7. **Pins and nails are made to have pointed end because**
   1) it transmits very small pressure
   2) it transmits a large pressure
   3) it provide a large area
   4) None of the above

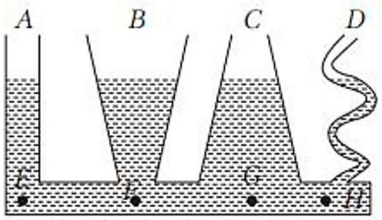
8. **The two thigh bones each of cross-sectional area 15 cm^2 support the upper part of a person of mass 70 kg. The pressure sustained by these thigh bones is**
   1) 2.5×10^5 Nm^{-2}
   2) 1.33×10^5N m^{-2}
   3) $4.66 \times 10^5 \times 10^5$Nm^{-2}
   4) 2.33×10^5N m^{-2}

9. At a depth of 500 m in an ocean, what is the absolute pressure? Given that the density of sea water is 1.03×10^3 kg m^{-3} and g = 10 ms^{-2}

1) 40 atm 2) 52atm

3) 32 atm 4) 62 atm

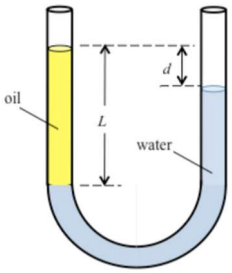
10. Four vessels A, B, C and D have different shapes and hold different amount of water. Which of the following is correct?



1) $p_E > p_F > p_G > p_H$ 2) $p_E < p_F < p_G < p_H$

3) $p_E = p_F = p_G = p_H$ 4) $p_E = p_F > p_G = p_H$

11. The U-tube in figure contains two different liquids in static equilibrium, water in the right arm and oil of unknown density ρ_x in the left. If l = 135 mm and d = 15 mm. Density of the oil is



1) 1000 kgm^{-3} 2) 920 kgm^{-3}

3) 895 kgm^{-3} 4) 900 kgm^{-3}

12. A sphere is floating in water its 1/3rd part is outside the water and when sphere is floating in unknown 3 liquid, its $\frac{3}{4}$ th part is outside the liquid then density of liquid is

1) 4/9 gm/c.c. 2) 9/4 gm/c.c.

3) 8/3 gm/c.c. 4) 3/8 gm/c.c.

13. Which of the following works on Pascal's law?

1) Sprayer 2) Venturimeter

3) Hydraulic lift 4) Aneroid barometer

14. Hydraulic press is based upon

l) Archimede's principle

2) Bernoulli's theorem

3) Pascal's law

4) Reynold's number

15. Assertion: The apparent weight of a floating body is zero.

Reason: The weight of the block acting vertically downwards is balanced by the buoyant force acting on the block upwards.

1) Assertion is correct, reason is correct, reason is a correct explanation for assertion.

2) Assertion is correct, reason is correct; reason is not a correct explanation for assertion

3) Assertion is correct, reason is incorrect

4) Assertion is incorrect, reason is correct.

16. An iceberg is floating in ocean. What fraction of its volume is above the water? (Given: density of ice = 900kg/m^3 and density of ocean water = 1030 kg/m^3)

1) $\frac{90}{103}$ 2) $\frac{13}{103}$ 3) $\frac{10}{103}$ 4) $\frac{1}{103}$

17. Beyond the critical speed, the flow of fluids becomes

1) streamline 2) turbulent

3) steady 4) very slow

18. Streamline flow is more likely for liquids with

1) high density and low viscosity

2) low density and high viscosity

3) high density and high viscosity

4) low density and low viscosity

19. For flow of a fluid to be turbulent.

1) fluid should have high density

2) velocity should be large

3) reynold number should be less than 2000

4) both (1) and (2)

20. In Bernoulli's theorem which of the following is conserved?

1) Mass

2) Linear momentum

3) Energy

4) Angular momentum

21. Air flows horizontally with a speed v = 106 km/hr. A house has plane roof of area $A = 20m^2$. The magnitude of aerodynamic lift of the roof is

1) 1.127×10^4 N 2) 5.0×10^4 N

3) 1.127×10^5 N 4) 3.127×10^4 N

22. Assertion: Lifting of aircraft is caused by pressure difference brought by varying speed of air molecules.

Reason: As the wings/ aerofoils move against the wind, the streamlines crowd more above them than below, causing higher velocity above than below.

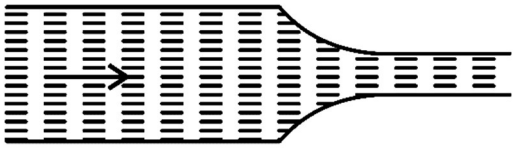
1) Assertion is correct, reason is correct; reason is a correct explanation for assertion

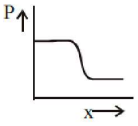
2) Assertion is correct, reason is correct; reason is not a correct explanation for assertion

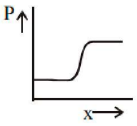
3) Assertion is correct, reason is incorrect

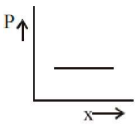
4) Assertion is incorrect, reason is correct.

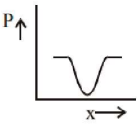
23. Water flows through a frictionless duct with a cross-section varying as shown in figure. Pressure P at points along the axis is represented by



1) 

2) 

3) 

4) 

24. Application of Bernoulli's theorem can be seen in

1) Dynamic lift to aeroplane

2) Hydraulic press

3) Speed Boat

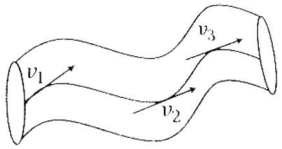
4) None of these

25. The velocity of water flowing in a non-uniform tube is 20 cm/s at a point where the tube radius is 0.2 cm. The velocity at another point, where the radius is 0.1 cm is

1) 80cm/s 2) 40cm/s

3) 20cm/s 4) 5cm/s

26. Consider streamline flow of a liquid flowing through a tube as shown in the figure, which of the following is correct regarding velocities of liquid at different points?



1) v_1 = constant, v_2 = constant, v_3 = constant

2) $v_1 \neq v_2 \neq v_3$

3) $v_1 = v_2 = v_3$

4) Both (a) and (b) are correct

27. If R_e is the Reynold's number, then which of the following is incorrect?

1) For $R_e < 1000$, flow is laminar

2) For $1000 < R_e < 2000$, flow is steady

3) For $R_e > 2000$, flow is turbulent

4) All are incorrect

28. If the velocity head of a stream of water is equal to 10 cm, then its speed of flow is approximately.

1) $1.0 ms^{-1}$ 2) $1.4 ms^{-1}$

3) $140 ms^{-1}$ 4) $10 ms^{-1}$

29. The ratio of the terminal velocities of two drops of radii R and R/2 is

1) 2 2) 1 3) 1/2 4) 4

30. Speed of 2 cm radius ball in a viscous liquid is 20 cm/s. Then the speed of 1 cm radius ball in the same liquid is

1) 5 cm/s 2) 10 cm/s

3) 40 cm/s 4) 80 cm/s

31. The velocity of falling rain drop attain limited value because of.

1) Surface tension

2) upthrust due to air

3) viscous force exerted by air

4) air current

32. Poise is the unit of.

1) Pressure 2) Friction

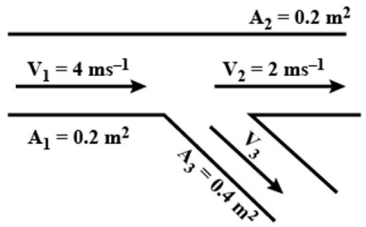
3) Surface tension 4) Viscocity

33. The relative velocity of two parallel layers of water is 8 cm/ sec If the perpendicular distance between the layers is 0.1 cm. Then the velocity gradient will be

1) 80/sec 2) 60/sec

3) 50/sec 4) 40/sec

34. In the figure, the velocity V_3 will be



1) Zero 2) $4 ms^{-1}$ 3) $1 ms^{-1}$ 4) $3 ms^{-1}$

35. Assertion: Falling raindrops acquire a terminal velocity.

Reason: A constant force in the direction of motion and a velocity dependent force opposite to the direction of motion, always result in the acquisition of terminal velocity.

1) Assertion is correct, reason is correct; reason is a correct explanation for assertion

2) Assertion is correct, reason is correct; reason is not a correct explanation for assertion

3) Assertion is correct, reason is incorrect

4) Assertion is incorrect, reason is correct.

36. Surface tension of a liquid is due to

1) gravitational force between molecules

2) electrical force between molecules

3) adhesive force between molecules

4) cohesive force between molecules

37. A liquid drop of diameter D breaks into 27 tiny drops. The resultant change in energy is—

1) $2 \pi TD^2$ 2) $4\pi TD^2$

3) n TDS 4) None of these

38. Two water droplets merge with each other to form a larger droplet. In this process

1) energy is liberated

2) energy is absorbed

3) energy is neither liberated nor absorbed

4) some mass is converted into energy

39. Due to capillary action, a liquid will rise in a tube if angle of contact is

1) acute 2) obtuse 3) 90° 4) zero

40. With the increase in temperature, the angle of contact

1) decreases

2) increases

3) remains constant

4) sometimes increases and sometimes decreases

41. If a capillary of radius r is dipped in water, the height of water that rises in it is h and its mass is M. If the radius of the capillary is doubled the mass of water that rises in the capillary will be

1) 4M 2) 2M 3) M 4) M/2

42. The spherical shape of rain-drop is due to

1) Density of the liquid

2) surface tension

3) Atmospheric pressure

4) Gravity

43. Surface tension of a liquid is 5 N/m. If its thin film is made in a ring of area 0.02 m^2, then its surface energy will be –

1) 5×10^{-2} Joule 2) 2.5×10^{-2} Joule

3) 3×10^{-1} Joule 4) 2×10^{-1} Joule

44. Water rises to a height h in a capillary at the surface of earth. On the surface of the moon the height of water column in the same capillary will be :

1) 6h 2) 1/6 h 3) h 4) Zero

45. A liquid does not wet the sides of a solid, if the angle of contact is

1) Zero

2) Obtuse(morethan90°)

3) Acute (less than 90^0) 4) 45°

46. Which of the following is not the unit of surface tension?

1) N/m 2) J/m^2

3) kg/s^2 4) W/m

47. Which of the following statement is true in case when two water drops coalesce and make a bigger drop?

1) Energy is released.

2) Energy is absorbed.

3) The surface area of the bigger drop is greater than the sum of the surface areas of both the drops.

4) The surface area of the bigger drop is same that of the sum of the surface areas of both the drops.

LEVEL-1 KEY

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
3	4	2	4	3	2	2	4	2	3
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
4	3	3	3	1	2	2	2	4	3
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
1	1	1	1	1	4	2	2	4	1
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
3	4	1	3	1	4	1	1	1	1
41	**42**	**43**	**44**	**45**	**46**	**47**			
2	2	4	1	2	4	1			

LEVEL-2

1. An object of weight W and density ρ is submerged in a fluid of density ρ_1. Its appearent weight will be

1) $W(\rho-\rho_1)$ 2) $\frac{(\rho-\rho_1)}{W}$

3) $W\left(1-\frac{\rho_1}{\rho}\right)$ 4) $W(\rho_1-\rho)$

2. Which law states that the magnitude of pressure within fluid is equal in all parts?

1) Pascal's law 2) Gay-Lusac's law

3) Dalton's law 4) Boyle's law

3. A body measures 5 N in air and 2 N when put in water. The buoyant force is

1) 7 N 2) 9 N 3) 3 N 4) None of these

4. Which of the following is correct?

1) Gauge pressure = Absolute pressure + Atmospheric pressure

2) Absolute pressure = Gauge pressure — Atmospheric pressure

3) Gauge pressure = Absolute pressure — Atmospheric pressure

4) Absolute pressure = Atmospheric pressure — Gauge pressure

5. In a vehicle lifter, the enclosed gas exerts a force F on a small piston having a diameter of 8 cm. This pressure is transmitted to a second piston of diameter 24 cm. If the mass of the vehicle to be lifted is 1400 kg, then value of F is

1) 1200 N 2) 1800 N

3) 1600 N 4) 700 N

6. What will be the length of mercury column in a barometer tube when the atmospheric pressure is x cm of mercury and the tube is inclined at an angle ϕ with the vertical direction?

1) $\frac{x}{\sin\phi}$ 2) $\frac{x}{\cos\phi}$ 3) $\frac{x}{\tan\phi}$ 4) x

7. Specific gravity of a body is numerically equal to

1) weight of the body in air

2) weight of the body in water

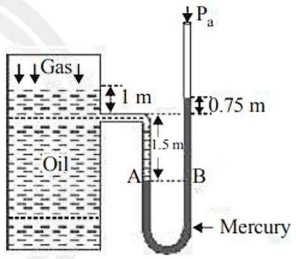
3) relative density of the body

4) density of body in water

8. If a solid floats with 1/4th of its volume above the surface of water, then density of the solid (ρ_s) is related to density of water (ρ_w) as

1) $\rho_s=\rho_w$ 2) $\rho_s=\frac{1}{4}\rho_w$ 3) $\rho_s=\frac{3}{4}\rho_w$ 4) $\rho_s=\frac{4}{3}\rho_w$

9. What is the absolute pressure of the gas above the liquid surface in the tank shown in fig. Density of oil = 820 kg/ m^3, density of mercury = 13.6 × 10^3 kg/m^3. Given 1 atmospheric pressure = 1.01 × 10^5 N/m^2.



1) 3.81 × 105 N/m^2 2) 6 × 106 N/m^2

3) 5 × 107 N/m^2 4) 4.6 × 10^2 N/m^2

10. Two water pipes P and Q having diameter 2 ×10^{-2}m and 4 × 10^{-2}m respectively are joined in series with the main supply line of water. The velocity of water flowing in pipe P is

1) 4 times that of Q 2) 2 times that of Q

3) $\frac{1}{2}$ times that of Q 4) $\frac{1}{4}$ times that of Q

11. Water from a tap emerges vertically downwards with an initial speed of 1.0 m/s. The cross-sectional area of tap is 10^{-1} m^2. Assume that the pressure is constant throughout the stream of water and that the flow is steady, the cross-sectional area of stream 0.15 m below the tap is:

1) 5.0 × 10^{-4} m^2 2) 1.0 × 10^{-4} m^2

3) 5.0 × 10^{-5} m^2 4) 2.0 × 10^{-5} m^2

12. Which of the following statements are true about streamline flow?

I. Path taken by a fluid particle under a steady flow is a streamline

II. No two streamlines can cross each other

III. Velocity increases at the narrower portions where the streamlines are closely spaced

1) I & II only 2) II & III only

3) I & III only 4) I, II & III

13. In which flow the velocity of fluid particles reaching a particular point is same at all time?

1) vigrous flow 2) steady flow

3) turbulant flow 4) None of these

14. A tank of height 5 m is full of water. There is a hole of cross-sectional area 1 cm^2 in its bottom. The initial volume of water that will come out from this hole per second is

1) $10^{-3} m^3/s$ 2) $10^{-4} m^3/s$

3) $10 m^3 s$ 4) $10^{-2} m^3/s$.

15. Application of Bernoulli's theorem can be seen in

1) Dynamic lift to aeroplane

2) Hydraulic press

3) Speed Boat

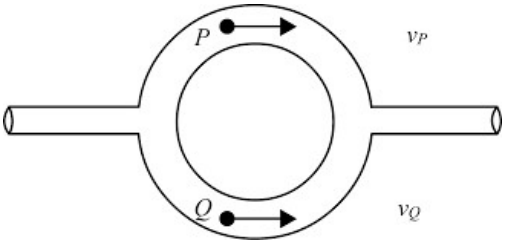
4) None of these

16. The flow speeds of air on the lower and upper surfaces of the wing of an aeroplane are v and $\sqrt{2}v$ respectively. The density of air is ρ and surface area of wing is A. The dynamic lift on the wing is:

1) $\rho v^2 A$ 2) $\sqrt{2}\rho v^2 A$

3) $(1/2)\rho v^2 A$ 4) $2\rho v^2 A$

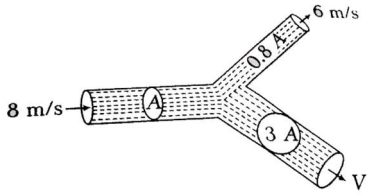
17. Figure shows a liquid flowing through a tube at the rate of 0.1 m^3/s. The tube is branched into two semi-circular tubes of cross-sectional area A/3 and 2A/3. The velocity of liquid at Q is (the cross-section of the main tube is A = 10^{-2} m^2 and Vp = 20 m/s)



1) 5 m/s 2) 30 m/s

3) 35 m/s 4) None of these

18. An incompressible liquid is flowing through a horizontal pipe as shown in figure. The value of speed v is



1) $1 ms^{-1}$ 2) $2.1 ms^{-1}$ 3) $3.1 ms^{-1}$ 4) $5.1 ms^{-1}$

19. A tank is filled to a height H. The range of water coming out of a hole which is a depth H/4 from the surface of water level is

1) $\frac{2H}{\sqrt{3}}$ 2) $\frac{\sqrt{3}H}{2}$ 3) $\sqrt{3}H$ 4) $\frac{3H}{2}$

20. Water is in streamline flows along a horizontal pipe with non-uniform cross-section. At a point in the pipe, where the area of cross-section is 10 cm^2, the velocity of water is 1 ms^{-1} and the pressure is 2000 Pa. The pressure at another point, where the cross-sectional area is 5 cm^2, is

1) 4000 Pa 2) 2000 Pa

3) 1000 Pa 4) 500 Pa

21. After terminal velocity is reached, the acceleration of a body falling through a fluid is

1) equal to g 2) zero

3) less than g 4) greater than g

22. A liquid is filled upto a height of 20 cm in a cylindrical vessel. The speed of liquid coming out of a small hole at the bottom of the vessel is (g =10 ms^{-2})

1) 1.2 ms^{-1} 2) 1 ms^{-1} 3) 2 ms^{-1} 4) 3.2 ms^{-1}

23. A small spherical ball falling through a viscous medium of negligible density has terminal velocity v. Another ball of the same mass but of radius twice that of the earlier falling through the same viscous medium will have terminal velocity

1) v 2) v/4 3) v/2 4) 2v

24. Two drops of equal radius are falling through air with a steady velocity of 5 cm/s. If the two drops coalesce, then its terminal velocity will be

1) $4^{1/3} \times 5$cm/s 2) $4^{1/3}$ cm/s

3) $5^{1/3} \times 4$cm/s 4) $4^{2/3} \times 5$cm/s

25. If the terminal speed of a sphere of gold (density =19.5 kg/m3) is 0.2 m/s in a viscous liquid (density = 1.5 kg/m^3), find the terminal speed of a sphere of silver (density =10.5 kg/m^3) of the same size in the same liquid.

1) 0.4 m/s 2) 0.133 m/s

3) 0.1 m/s 4) 0.2 m/s

26. Speed of 2 cm radius ball in a viscous liquid is 20 cm/s. Then the speed of 1 cm radius ball in the same liquid is

1) 5 cm/s 2) 10 cm/s 3) 40 cm/s 4) 80 cm/s

27. Two equal drops of water are falling through air with a steady velocity v. If the drops coalesce, the new velocity be will be

1) 2v 2) $\sqrt{2}$v 3) $2^{2/3}$v 4) $\frac{v}{\sqrt{2}}$

28. Two rain drops falling through air have radii in the ratio 1:2. They will have terminal velocity in the ratio.

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

29. A drop of water of radius 0.0015 mm is falling in air. If the coefficient of viscosity of air is 2.0×10^{-5} kg / (m-s), the terminal velocity of the drop will be (The density of water = 1.0×10^3 kg/m^3 and g = 10 m/s^2)

1) 1.0×10^{-4} m/s 2) 2.0×10^{-4} m/s

3) 2.5×10^{-4} m/s 4) 5.0×10^{-4} m/s

30. For a given volume which of the following will have minimum energy?

1) Cube 2) Cone

3) Sphere 4) All have same energy

31. Work done in increasing the size of a soap bubble from radius 3 cm to 5 cm is nearly (surface tension of soap solution = 0.03 Nm^{-1})

1) 0.2 πm J 2) 2 πm J

3) 0.4 πm J 4) 4 πm J

32. In a capillary tube, water rises to 3 mm. The height of water that will rise in another capillary tube having one-third radius of the first is

1) 1 mm 2) 3 mm

3) 6 mm 4) 9 mm

33. If two soap bubbles of equal radii r coalesce, then the radius of curvature of interface between two bubbles will be

1) r 2) 0

3) infinity 4) r/2

34. The height upto which liquid rises in a capillary tube is 2Scos π given by $h = \frac{2S\cos\theta}{h\rho g}$ this is for which of the following hρg cases, water will be depressed in such a tube?

1) θ is acute 2) θ is a right angle

3) θ is zero 4) θ is obtuse

35. If 'M' is the mass of water that rises in a capillary tube of radius 'r', then mass of water which will rise in a capillary tube of radius '2r' is:

1) M 2) M/2

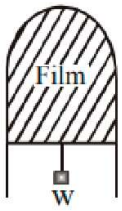
3) 4 M 4) 2M

36. The work done in increasing the size of a soap film from 10 cm × 6 cm to 10 cm × 11 cm is 3×10^{-4} J. The surface tension of the film is

1) 11×10^{-2} N/m 2) 6×10^{-2} N/m

3) 3×10^{-2} N/m 4) 1.5×10^{-2} N/m

37. A thin liquid film formed between a U-shaped wire and a light slider supports a weight of 1.5×10^{-2} N (see figure). The length of the slider is 30 cm and its weight negligible. The surface tension of the liquid film is:



1) 0.025 N/m 2) 0.0125 N/m

3) 0.1 N/m 4) 0.05 N/m

38. In a capillary tube, water rises by 1.2 mm. The height of water that will rise in another capillary tube having half the radius of the first, is:

1) 1.2 mm 2) 2.4 mm 3) 0.6 mm 4) 0.4mm

39. Surface tension of a liquid is 5 N/m. If its thin film is made in a ring of area 0.02 m^2. then its surface energy will be –

1) 5×10^{-2} Joule 2) 2.5×10^{-2} Joule

3) 3×10^{-1} Joule 4) 2×10^{-1} Joule

40. The radius of a soap bubble is r. The surface tension of soap solution is T. Keeping temperature constant, the radius of the soap bubble is doubled, the energy necessary for this will be

1) $24\ \pi r^2T$ 2) $8\ \pi rT$

3) $12\ \pi r^2T$ 4)$16\pi r^2T$

41. Two small drops of mercury, each of radius R, coalesce to form a single large drop. The ratio of the total surface energies before and after the change is :-

1) $1: 2^{1/3}$ 2) $2^{1/3}:1$

3) 2: 1 4) 1 : 2

42. Inside a drop excess pressure is maximum in :-

1) 0.200 μm diameters

2) 20.0 μm diameters

3) 200 μm diameters

4) 2.0 μm diameters

43. The work done in blowing a soap bubble of radius 0.2 m, given that the surface tension of soap solution is 60×10^{-3} N/m, is

1) $24\ \pi \times 10^{-4}$ J 2) $8\ \pi \times 10^{-4}$ J

3) $96\ \pi \times 10^{-4}$ J 4) $192\ \pi \times 10^{-4}$ J

LEVEL-2 KEY

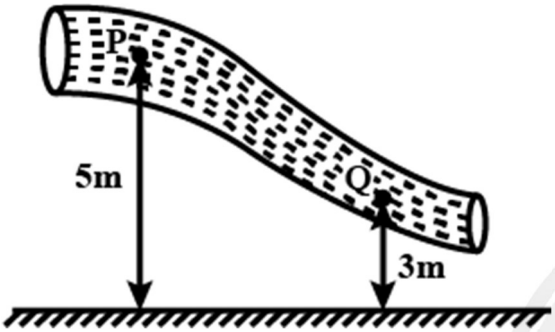
1	2	3	4	5	6	7	8	9	10
3	1	3	3	3	2	3	3	1	1
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
3	4	2	1	1	3	1	1	2	4
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
2	3	3	1	3	1	3	2	3	3
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
3	4	3	4	4	3	1	2	4	1
41	**42**	**43**							
2	1	4							

LEVEL-3(PREVIOUS YEARQUESTIONS)

1. The wettability of a surface by a liquid depends primarily on:- [NEET – 2013]

1) angle of contact between the surface and the liquid
2) viscosity
3) surface tension
4) density

2. A non-viscous fluid of constant density of 1000 kg/m^3 flows in a stream line motion along a tube of variable cross-section. [AIIMS – 2013]



The area of cross-section at two P and Q at lengths 5 m and 3 m are 40 cm^2 and 20 cm^2 respectively. If velocity of fluid at P is 3 m/s then find velocity of fluid at Q.

1) 3 m/s 2) 4 m/s 3) 5 m/s 4) 6 m/s

3. A certain number of spherical drops of a liquid of radius V coalesce to form a single drop of radius R' and volume V. If T is the surface tension of the liquid, then: [AIPMT-2014]

1) energy = $4VT\left(\frac{1}{r}-\frac{1}{R}\right)$ is released

2) energy = $3VT\left(\frac{1}{r}+\frac{1}{R}\right)$ is absorbed

3) energy = $3VT\left(\frac{1}{r}-\frac{1}{R}\right)$ is released

4) Energy is neither released nor absorbed

4. A wind with speed 40 m/s blows parallel to the roof of a house. The area of the roof is 250 m^2. Assuming that the pressure inside the house is atmospheric pressure, the force exerted by the wind on the roof and the direction of the force will be: (ρ_{air} = 1.2 kg/m^3) [AIPMT-2015]

1) 4.8×10^5 N, upwards
2) 2.4×10^5 N, upwards
3) 2.4×10^5 N, downwards
4) 4.8×10^5 N, downwards

5. The cylindrical tube of a spray pump has radius R, one end of which has n fine holes, each of radius r. If the speed of the liquid in the tube is V, the speed of the ejection of the liquid through the holes is:- [AIPMT-2015]

1) $\frac{VR^2}{nr^2}$ 2) $\frac{VR^2}{n^3r^2}$

3) $\frac{V^2R}{nr}$ 4) $\frac{VR^2}{n^2r^2}$

6. A rectangular film of liquid is extended from (4 cm × 2 cm) to (5 cm × 4 cm). If the work done is 3×10^{-4} J, the value of the surface tension of the liquid is:- [NEET – 2016]

1) 0.2Nm^{-1} 2) 8.0 Nm^{-1}
3) 0.250 Nm^{-1} 4) 0.125 Nm^{-1}

7. Three liquids of densities ρ_1, ρ_2 and ρ_3 (with $\rho_1 > \rho_2 > \rho_3$), having the same value of surface tension T, rise to the same height in three identical capillaries. The angles of contact θ_1, θ_2 and θ_3 obey:- [NEET – 2016]

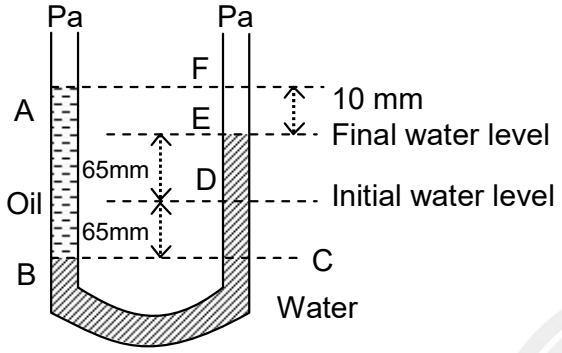
1) $\frac{\pi}{2} < \theta_1 < \theta_2 < \theta_3 < \pi$

2) $\theta_1 > \theta_2 > \theta_3 > \pi > \frac{\pi}{2}$

3) $\frac{\pi}{2} > \theta_1 > \theta_2 > \theta_3 \geq 0$

4) $0 < \theta_1 < \theta_2 < \theta_3 < \frac{\pi}{2}$

8. A U tube with both ends open to the atmosphere, is partially filled with water. Oil, which is immiscible with water, is poured into one side until it stands at a distance of 10 mm above the water level on the other side. Meanwhile the water rises by 65 mm from its original level (see diagram). The density of the oil is : [NEET 2017]



1) 650 kg m^{-3} 2) 425 kg m^{-3}

3) 800 kg m^{-3} 4) 928 kg m^{-3}

9. A small sphere of radius r falls from rest in a viscous liquid. As a result, heat is produced due to viscous force. The rate of production of heat when the sphere attains its terminal velocity, is proportional to [NEET 2018]

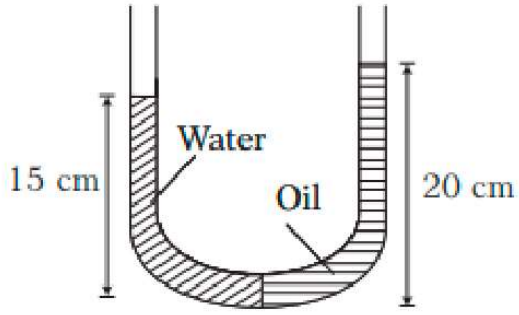
1) r^5 2) r^2 3) r^3 4) r^4

10. Two small spherical metal balls having equal masses are made from materials of densities ρ_1 and ρ_2 ($\rho_1 = 8\,\rho_2$) and have radii of 1 mm and 2 mm, respectively. They are made to fall vertically (from rest) in viscous medium whose coefficient of viscosity equals $\eta$and whose density is 0.1 ρ_2. The ratio of their terminal velocities would be. [NEET (Odisha) 2019]

1) $\frac{79}{72}$ 2) $\frac{19}{36}$

3) $\frac{39}{72}$ 4) $\frac{79}{36}$

11. In a u-tube as shown in the figure water and oil are in the left side and right side of the tube respectively. The heights from the bottom for water and oil columns are 15 cm and 20 cm respectively. The density of the oil is: [take ρ_{water} = 1000 kg/m^3] [NEET_2019-II]



1) 1200 kg/m^3 2) 750 kg/m^3

3) 1000 kg/m^3 4) 1333 kg/m^3

12. A barometer is constructed using a liquid (density — 760 kg/m^3). What would be the height of the liquid column, when a mercury barometer reads 76 cm? (Take, density of mercury = 13600 kg/m^3) [NEET 2020]

1) 1.36 m 2) 13.6 m

3) 136 m 4) 0.76 m

13. A liquid does not wet the solid surface, if the angle of contact is [NEET 2020]

1) equal to 45° 2) equal to 60°

3) greater than 90° 4) zero

14. A capillary tube of radius r is immersed in water and water rises in it to a height h. The mass of the water in the capillary tube is 5 g. Another capillary tube of radius 2r is immersed in water. The mass of water that will rise in this tube is [NEET 2020]

1) 5.0 g 2) 10.0 g

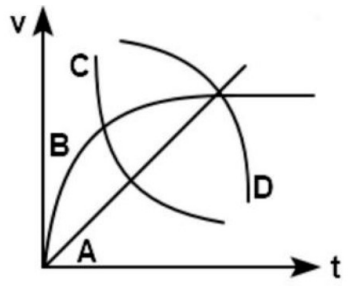
3) 20.0 g 3) 2.5 g

15. The velocity of a small ball of mass M and density d, when dropped in a container filled with glycerine becomes constant after some time. If the density of glycerine is 4 then the viscous force acting on the ball will be:

1) $\frac{3Mg}{2}$ 2) 2Mg **[NEET 2021]**

3) $\frac{Mg}{2}$ 4) Mg

16. A spherical ball is dropped in a long column of a highly viscous liquid. The curve in the graph shown, which represents the speed of the ball (v) as a function of time (t) is: [NEET 2022]



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

17. Air is pushed carefully into a soap bubble of radius r to double its radius. If the surface tension of the soap solution is T, then work done in the process is: [NEET 2022]

1) $12\pi r^2T$ 2) $24\pi r^2T$

3) $4\pi r^2T$ 4) $8\pi r^2T$

18. If a soap bubble expands, the pressure inside the bubble: [NEET 2022]

1) is equal to the atmospheric pressure

2) decreases

3) increases

4) remains the same

19. The amount of energy required to form a soap bubble of radius 2 cm from a soap solution is nearly: (surface tension of soap solution 0.03 Nm^{-1}) [NEET 2023]

1) 50.1×10^{-4} J 2) 30.16×10^{-4} J

3) 5.06×10^{-4} J 4) 3.01×10^{-4} J

20. The venturi-meter works on: [NEET 2023]

1) The principle of perpendicular axes

2) Huygen's principle

3) Bernoulli's principle

4) The principle of parallel axes

LEVEL-3 KEY

1	2	3	4	5	6	7	8	9	10
1	4	3	2	1	4	4	4	1	4
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
2	2	3	3	3	3	2	2	4	3

E-TECH ACADEMY Study Center

OPEN TO ALL

PEACEFUL ENVIORNMENT

FREE WIFI

DOUBT SUPPORT

SEPARATE DESK

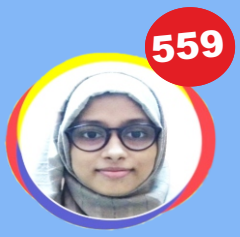
TOPPERS 2023


615
SARFARAJ ALAM
NEET 2023


615
ANAS GAUR
NEET 2023

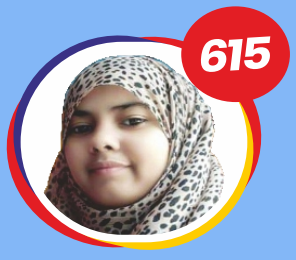

565
MOHD AFFAN
NEET 2023


560
AMAN SHAH
NEET 2023


559
AQSA KHAN
NEET 2023

TOPPERS 2022


615
AFREEN BANO
NEET 2022

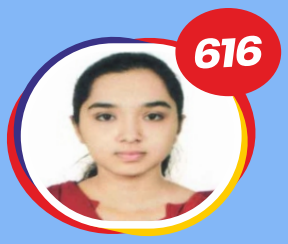

615
SONIYA PARVEEN
NEET 2022


604
MOHD ZEESHAN
NEET 2022


575
SHAH MOHD IZHAR
NEET 2022

TOPPERS 2021


636
SANTOSH
KUMAR YADAV
NEET 2021


616
AKABANI
SADAF YUSUF
NEET 2021


600
SUSHIL
KUMAR GUPTA
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