Anekant Education Society's

TULJARAM CHATURCHAND COLLEGE OF ARTS, SCIENCE AND COMMERCE, BARAMTI

An Autonomous status

(Affiliated to Savitribai Phule Pune University, Pune)

DEPARTMENT OF PHYSICS

Physics P-I: PHY1101: Mechanics and Properties of matter

Question Bank for F.Y.B.Sc students

INDEX

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Physics P-I: PHY 1101: Mechanics and Properties of matter

Question Bank for F.Y.B.Sc students

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Chapter-1: Motion

Objective Questions

1. A body of weight w_1 is suspended from the ceiling of a room through a chain of weight w_2. The ceiling pulls the chain by a force

a) w_1

b) w_2

c) w_1+w_2

d) $w_1+w_2/_2$

2. When a horse pulls a cart, the force that helps the horse to move forward is the force exerted by

a) The cart on the horse

b) The ground on the horse

c) The ground on the cart

d) The horse on the ground

3. A car accelerates on a horizontal road due to the force exerted by

a) The engine of the car

b) The driver of the car

c) The earth

d) The road

4. A block of mass m is placed on a smooth inclined plane of inclination θ with the horizontal. The force exerted by the plane on the block has a magnitude

a) mg

b) mg/cosθ

c) mgcosθ

d)mgtanθ

5. Neglect the effect of rotation of earth. Suppose the earth suddenly stops attracting objects placed near its surface. A person standing on the surface of the earth will

a) Fly up

b) Slip along the surface

c) Fly along a tangent to the earth's surface

d) Remains standing.

6. Three rigid rods are joined to form an equilateral triangle ABC of side 1 m. Three particles carrying charges 20 μC each are attached to the vertices of the triangle. The whole system is at rest is an inertial frame. The resultant force on the charged particle at A has the magnitude

a) zero

b) 3.6 N

c) 3.6 √3

d) 7.2 N

7. A force F_1 acts on a particle so as to accelerate it from rest to a velocity V. The force F_1 is then replaced by F_2 which decelerates it to rest

a) F_1 must be equal to F_2

b) F_1 may be equal to F_2

c) F_1 must be unequal to F_2

d) none of these

8. A smooth wedge A is fitted in a chamber hanging from a fixed ceiling near the earth's surface. A block B placed at the top of the wedge takes a time T to slide down the length of the wedge. If the block is placed at the top of the wedge and the cable supporting the chamber is broken at the same instant, the block will

a) Take a time longer than T to slide down the wedge

b) Take a time shorter than T to slide down the wedge

c) Remain at the top of the wedge

d) Jump off the wedge

9. A reference frame attached to the earth

a) is an inertial frame by definition

b) Cannot be an inertial frame because the earth is revolving around the sun

c) is an inertial frame because Newton's laws are applicable at this frame

d) Cannot be an inertial frame because the earth is rotating about the axis

10. The force exerted by the floor of an elevator on the foot of a person standing there is more than the weight of the person if the elevator is

a) Going up and slowing down

b) Going up and speeding up

c) Going down and slowing down

d) Going down and speeding up.

11. A person says that he measured the acceleration of a particle to be non zero while no force acting on the particle

a) He is liar

b) His clock might have run slow

c) His meter scale might have been longer than the standard

d) He might have used non-inertial frame

12. Swimming is possible on account of

a) First law of motion

b) Second law of motion

c) Third law of motion

d) Newton's law of gravitation

13. Velocity of a body of mass 20 kg decreases from 20 m/s in a distance of 100m. Force on body is

a) -27.5 N

b) -37.5 N

c) -47.5 N

d) -67.5 N

14. The average force to stop a hammer with 25 Ns momentum in 0.4 sec is

a) 625 N

b) 125 N

c) 50 N

d) 25 N

15. Which of the following quantities measured from different inertial frames are same?

a) Force

b) Velocity

c) Displacement

d) Kinetic energy

16. A man is standing on a spring balance. The reading of spring balance is 60kgf. If man jumps outside balance, then the reading of spring balance

a) First increases then decreases to zero

b) Decreases

c) Increases

d) Remains same

17. A batsman hits back a ball straight in the direction of bowler without changing its initial speed of 12 m/s, if mass of ball is 0.15 kg. Determine the impulse imparted to ball

a) 3.6 Ns

b) 36 Ns

c) 0

d) 0.225 N

18. The relationship among force, mass and acceleration is stated in

a) The law of conservation of momentum

b) Newton's first law of motion

c) Newton's second law of motion

d) Newton's third law of motion

19. When car takes turn around a curve road, the passengers feel force acting on them in a direction away from the center of the curve. It is due to

a) Centripetal force

b) Gravitational force

c) Their inertia

d) Centrifugal force

20. When collision between the bodies in system is inelastic in nature then for system momentum changes but K.E. remain conserve

a) K.E changes but momentum remains conserve

b) Both momentum and K.E changes

c) Both momentum and K.E remains conserve

d) None of them

Answer in one sentence

21. Define average velocity of motion
22. How average speed is defined?
23. What is force?
24. Define instantaneous velocity of motion
25. Can action and reaction forces cancel each other?
26. What is inertia?

Short Notes

27. Write a short note on gravitational force
28. Write a short note on electromagnetic force
29. Write short note on Pseudo force
30. Write short note on application of Newton's laws of motion
31. Write short note on limitations of Newton's laws of motion

Short Answer Questions

32. What is the difference between mass and weight?
33. Why Newton's first law is called law of inertia?
34. Explain inertial and non inertial frame of references.
35. Give three practical examples of Newton's third law
36. What is Pseudo force? Illustrates with examples
37. Stare Newton's law of gravitation
38. A ship of mass $2X10^7$ kg is at rest on the surface of water on applying a force of $25X10^5$ N, it is displayed through 25 m. Calculate the speed after this displacement.
39. A body of mass 25000 gm is acted upon by a force of 5 N. Find the acceleration of the body in S.I unit.
40. What a force is required to accelerate 1500 kg car from 5 m/s to 20 m/s in time 5 sec?

41. A man pulls a box of 12.4 kg with a force of 40 N inclined to the horizontal at an angle of 300, as a result the box accelerates horizontally. What is the magnitude of acceleration?

42. A sphere of mass 40 kg is attracted by a second sphere of mass 80 kg with a force equal to the weight of ¼ milligram. If their centers are 30 cm apart, calculate the constant of gravitation, if g=9.8 m/s^2

43. Determine the acceleration which result when a 15 N net force is applied to a 3 kg object and then to a 6 kg object

44. A hockey stick exerts a force 200 N on a 0.2 kg puck for 0.1 second. What is the final speed of the puck?

45. A 20 kg mass is hanging at the end of wire. Calculate the tension force in the wire, if the acceleration of the mass is 2 m/s^2 in the upward and downward direction

46. A small block B is placed on another block A of mass 9 kg and length 20 cm. Initially the block B is near the right end of block A. A cost horizontal force of 20 N is applied to the block A. All the surfaces are assumed to be frictionless. Find the time elapsed before the block B separates from A.

47. A body of mass m is suspended by two strings making angles α and β with the horizontal. Find the tension in the strings.

48. A position of a car on a straight road with time is given by the function of time, $X(t)= 10+25t+5t^2$ in meters when t is in seconds. Find the instantaneous velocities at
a) t=1 sec b) t=5 sec and c) t= 10 sec.

49. The position of a particle moving along straight line is given by $X= 5t^3-2t^2+4$
Find 1) average acceleration between t= 2 s and t = 4 s 2) acceleration at t= 3s

50. The velocity of a particle moving along the x axis varies in time according to the expression $v= 35-5t^2$, where t is in seconds. Find a) The average acceleration in the time interval t=0 to t= 2 s, b) the average acceleration in the time interval t=4 s to t=5 s. What is the significance of the sign of your answer in both the cases?

51. The position of a particle along X axis is given by
$X= 3-4t+8t^2$ Find the acceleration of the particle at t=2 s.

52. Figure shows two masses m_1 and m_2 connected by a thread. If the kinetic friction between m_1 and table is 19.6 N, find the acceleration of the system

53. A body stands on a weighing machine inside the lift. When the lift is going down with an acceleration 4 m/s^2, the machine shows a reading 30 kg wt. When the lift goes upward at an acceleration 4m/s^2, find the reading, which will be shown by machine.

54. A worker applies a constant horizontal force with magnitude 40 N to a box with mass 80 kg resting on a frictionless horizontal surface. What is the acceleration of the box along horizontal direction?

Long Answer Questions

55. State and explain Newton's first law of motion

56. State and explain Newton's Second law of motion

57. State and explain Newton's third law of motion

58. Explain applications of Newton's law of motion in real life

59. What are the limitations of the Newton's laws of motion?

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Chapter-2: Work and Energy

Objectives

1. What is the unit of energy in SI system?

a) Joule

b) erg

c) Watt

d) Newton

2. An object of mass 100 g is moving with velocity 20 cm/s. What is its kinetic energy?

a) 2.1 X 10^5 erg

b) 2.0 X 10^5 erg

c) 2.0 X 10^4 erg

d) 2.5 X 10^4 erg

3. Due to application of 10 N forces an object moves 10 m along perpendicular direction of the force. What amount of work is done?

a) 100 erg

b) 100 joules

c) 50 joules

d) 500 joules

4. Formula for gravitational potential energy of mass m with gravitational pull g and raised to height h is

a) E_p= mg/h

b) E_p= m/gh

c) E_p= mgh

d) E_p=gh/m

5. Which of the following pair of physical quantity has same dimensions?

a) Work and energy

b) Work and power

c) Force and work

d) Power and force

6. According to work-energy theorem, a particle of mass m when subjected to external force, the work done during displacement by all the forces is equal to change in …….. during displacement.

a) Gravitational energy

b) Mechanical energy

c) Kinetic energy

d) Potential energy

7. The force is called conservative force for which work done is independent of

a) distance

b) path

c) time

d) none of these

8. According to the principle of conservation of energy, under which type of force, the sum of P.E. and K.E. of a particle remains constant?

a) conservative force

b) non-conservative force

c) frictional force

d) Viscous force

9. A heavy stone is thrown from a cliff of a height h in a given direction. The speed with which it hits the ground

a) must depend on the speed of projection

b) must be larger than the speed of projection

c) must be independent of the speed of projection

d) may be smaller than the speed of projection

10. A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle. The motion of the particle takes place in a plane. It follows that

a) its velocity is constant

b) its acceleration is constant

c) its kinetic energy is constant

d) it moves in a circular path.

11. You lift a suitcase from the floor and keep it on a table. The work done by you on the suitcase does not depend on

a) the path taken by the suitcase

b) the time taken by you in doing so

c) the weight of the suitcase

d) your weight

12. Consider two observers moving with respect to each other at a speed v along a straight line. They observe a block of mass m moving a distance *l* on a rough surface. The following quantities will be same as observed by the two observers

a) kinetic energy of the block at time t

b) work done by friction

c) total work done on the block

d) acceleration of the block

13. A block of mass m slides down a smooth vertical circular track. During the motion, the block is in

a) vertical equilibrium

b) horizontal equilibrium

c) radial equilibrium

d) none of these

14. Taking off rocket can be explained by

a) first law of motion

b) second law of motion

c) Law of conservation of momentum

d) law of conservation of energy

15. If velocity is doubled then

a) momentum increases 4 times and K.E increases 2 time

b) momentum and K.E remain same

c) momentum increases 2 times and K.E increases constant

d)) momentum increases 2 times and K.E increases 4 time

Answer in one sentence

16. Define kinetic energy of a body. Give its SI unit.
17. Define potential energy of a body. Give its SI unit.
18. What do you mean by work done? Give its SI unit.
19. Give the example of a force which does no work on the body.
20. State the condition under which a force does no work
21. Give examples of positive and negative work
22. What should be the angle between force and displacement so that no work is done?
23. Why the work done by earth's gravitational force in keeping the moon in its orbit is zero?

Short Notes

24. Write a short note on work energy theorem
25. Write a short note on conservative force.
26. Write a short note on non-conservative force.
27. Write a short note on law of conservation of energy

Short Answer Questions

28. State work energy theorem
29. Define conservative force. Give its example
30. Define non-conservative force. Give its example
31. Write the relation between mass of a particle and its equivalent energy
32. State law of conservation of energy
33. When the potential energy of a system is negative? Give the example of a system having negative potential energy
34. When the potential energy of a system is positive? Give the example of a system having negative potential energy
35. Explain potential energy. Give examples of a system having positive potential energy
36. Why friction force is no-conservative force?
37. A bullet of mass 50 gm is moving with a speed of 400 m/s. After passing through a solid substance, it is continued to move at the rate of 100 m/s. How much work the bullet had to do in passing through a solid substance?

38. Calculate the speed of the bob of a simple pendulum at its mean position. If the bob be able to rise a maximum vertical height of 5 cm. (Given: g=980 cm/s^2)

39. Find the work done in moving a particle along a vector r= (3i-j+6k) meter, if the applied force is F= (i+3j+2k) Newton.

40. A body of mass 30 gm is thrown vertically upwards with a speed of 15 m/s. Find the work done by the force of gravity during the time the body goes vertically up.

41. A body of mass 8 kg at rest is suspended by a force of 32 N, what is the kinetic energy required by the body at the end of 5 Sec?

42. The initial velocity of body is 16 m/s. What is its velocity after 2.5 Sec? If it accelerates uniformly at 4.5 m/s^2

43. A Charged oil drop of mass $4*10^{-16}$ Kg is accelerated from rest by a uniform electric field. If it acquires a speed of 30 m/s. while moving through a distance of 15 cm, then show that the work done by force of electric field on oil drop is equal to kinetic energy of oil drop after acceleration. (Assume that distance covered by charge oil drop is in the direction of force)

44. The metallic block of mass of 1.54 kg initially at rest is moved on a smooth frictionless surface of a table by horizontal force of 1 N. Calculate the work done by the force in 10 sec. and show that the work done by the force is equal to the change in kinetic energy of the block

45. A 10 kg object experiences a horizontal force which causes it to accelerate at 10 m/s^2, moving it a distance of 30 m horizontally . How much work is done by the force?

46. Find the work done by the person who uses force of 30.5N to move grocery buggy 12.3 m

47. A stone of mass 200 g is thrown vertically upwards with a velocity of 30 m/s. Find the potential energy at greatest height.

48. A shopper in a supermarket pushes a cart with a force of 45 N directed at an angle of 30^0 downwards from the horizontal. Find the work done by the shopper as he moves down and angle of 50 m length

49. Find the work done by a 50 N force in pulling the suitcase at an angle of 50^0 for a distance 75 m

50. A particle of mass 20 g is thrown vertically upwards with a speed of 10 m/s. Find the work done by the force of gravity during the time the particle goes up

51. The block of mass m attached to a spring of spring constant k, it oscillates on smooth horizontal table. The other end of spring is fixed to a wall. If it has a speed V when the spring is at its natural length, how far will it move on the table before coming to an instantaneous rest?

52. A force F= (10+0.50 x) acts on a particle in the x direction, where F is in Newton and x is in meter. Find the work done by this force during displacements from x= 0 to x= 2 m.

53. A body is dropped from a height H reaches the ground with a speed of 1.2 * $\sqrt{gH}$. Calculate the work done by air friction.

54. A block of mass M is pulled along a horizontal surface by applying a force at an angle θ with the horizontal. The friction coefficient between the block and the surface is μ, if the block travels at a uniform velocity. Find the work done by this applied force during the displacements d of the block.

Long Answer Questions

55. State and explain principle of conservation of energy

56. Explain the term work done. Calculate the work done by a constant force.

57. Define work done. Calculate the work done by a varying force.

58. State principle of conservation of energy. With suitable example show that energy of a body during motion is conserved

59. State and prove work-energy theorem

60. Define conservative force. With suitable example show that work done by conservative force during a round trip journey or closed path is equal to zero

61. Define non-conservative force. With suitable example show that work done by non-conservative force during a round trip journey is not equal to zero

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3. Elasticity

Objectives

1. Rain drops are spherical because of

a) Viscosity

b) Elasticity

c) Surface tension

d) Shortage of rain

2. For a constant force, a rope breaks due to stress. Which of the following is useful to reduce stress?

a) apply small force

b) increase the length of rope

c) increase cross sectional area of rope

d) use different material of rope

3. The modulus of rigidity and Poisson's ration of wire are 2.87 X 10^{10} N/m^2 and 0.379 respectively. What is the value of Young's modulus of material of wire?

a) 1.08773 X 10^{10} N/m^2

b) 7.5725 X 10^{10} N/m^2

c) 7.915 X 10^{10} N/m^2

d) 0.1403 X 10^{10} N/m^2

4. What is the effect of hammering on elasticity of material?

a) increase in elasticity

b) no change in elasticity

c) decrease in elasticity

d) breaks the material

5. What will happen to elastic properties of gold when potassium is added to gold?

a) no change in elastic property of gold

b) decrease in elastic property of gold

c) increase in elastic property of gold

d) breaks the material

6. When a rope is pulled on either side, what is the stress acting on it?

a) tangential stress

b) normal stress

c) compressive stress

d) tensile stress

7. A steel wire of length 2 m is acted upon by a load of 10 N. Calculate the strain produced in the wire if the energy stored in the wire is 1.1 X 10^{-3} J.

a) 0.55 X 10^{-4}

b) 1.1 X 10^{4}

c) 2.2 X 10^{-4}

d) 1.1 X 10^{-4}

8. Hooks law defines

a) stress

b) strain

c) elastic limit

d) modulus of elasticity

9. The bulk modulus of an ideal gas at constant temperature

a) is equal to its volume V

b) is equal to its pressure P

c) is equal to p/2

d) cannot be determined

10. The quality of the material which oppose the change in shape, volume or length is called

a) intermolecular repulsion

b) viscosity

c) intermolecular behaviour

d) elasticity

11. The longitudinal strain is only possible in

a) gases

b) solids

d) liquids

12. When compared with solids and liquids, the gases have

a) minimum volume elasticity

b) maximum Youngs modulus

c) Maximum volume elasticity

d) maximum modulus of rigidity

13. If the temperature increases, the modulus of elasticity

a) decreases

b) increases

c) remains constant

d) becomes zero

14. The motion of a torsional pendulum is

a) periodic

b) simple harmonic

c) oscillatory

d) angular simple harmonic

15. Which of the following will change the time period as they are taken to moon?

a) a simple pendulum

b) a torsional pendulum

c) a physical pendulum

d) a spring mass system

Answer in one sentence

16. Define the term stress and strain.

17. Explain, why steel is more elastic than rubber

18. Explain why only solids possess all the three constants of elasticity

19. State Hooks law of elasticity

20. Define Poisson's ratio

21. Define Young's modulus, bulk modulus and modulus of rigidity

22. What are elasticity and elastic bodies?

23. What is deforming force?

24. What is elastic limit?

25. Why not gases, liquids have young's modulus?

26. Distinguish between angle of twist and angle of shear
27. What are the limitations of the Hooks Law?
28. Why the bridges declared unsafe after long use?

Short Notes

29. Write short note on Hooks law of elasticity
30. Write a short note on Young's modulus, bulk modulus and modulus of rigidity
31. Write a short note on Poisson's ratio
32. Write a short note on stress and strain
33. Write a short note on torsional oscillations

Short Answer Questions

34. State Hooks law and what are the limitations of Hooks law?
35. Define Young's modulus, modulus of rigidity and bulk modulus and state the relation between them
36. Show that the work done during longitudinal strain per unit volume is equal to ½ X longitudinal stress X longitudinal strain
37. Show that the work done during volumetric strain per unit volume is equal to ½ X volumetric stress X volumetric strain
38. Show that the work done during shearing strain per unit volume is equal to ½ X shearing stress X shearing strain
39. Define Poisson's ratio. Show that the value of Poisson's ration cannot be greater than ½
40. Show that the value of Poisson's ration lies between -1 to 0.5
41. Obtain the relation between volume strain and longitudinal strain
42. Poisson's ration for a material is 0.379 and modulus of rigidity is 2.87 X 10^{10} N/m^2. Find Young's modulus of the material
43. Calculate the Poisson's ratio for the material, if Young's modulus is 6 X 10^{10} N/m^2 and bulk modulus is k= 11 X 10^{10} N/m^2
44. Calculate the value of Young's modulus if η=2 X 10^{10} N/m^2 and σ=0.25.
45. What pressure should be applied to a lead block to reduce its volume by 10 %? Bulk modulus of lead is 6 X 10^9 N/m^2
46. Calculate the Poisson's ration for material, if Young's modulus of metal is 8 X 10^{10} N/m^2 and η= 3 X 10^{10} N /m^2

47. Calculate the Poisson's ration σ for brass, if Y= 10X 10^{10} N/m^2 and K= 10X 10^{10} N/m^2

48. Calculate the Poisson's ratio for aluminum, if Young's modulus is 7.5X 10^{10} N/m^2 and modulus of rigidity is 2.5 X 10^{10} N/m^2

49. A wire of 0.8 m long and 1 square mm in cross section has Young's modulus is 1.24 X 10^{11} N/m^2. How much work is done in stretching it through 1 mm?

50. A uniform metal wire has length of 2 m and a diameter of 2 mm. When it is stretched by 0.5 mm, its diameter decreases by 0.15 μm. find the Poisson's ratio for the metal of the wire

51. A steel wire of length 4 m is acted upon by a load of 10 N. Calculate the strain produced in the wire, if the energy stored in the wire is 1.1 X 10^{-3} J.

52. The compressibility of water is 5 X 10^{-10} N/m^2. Find the change in volume of one liter of water when the pressure on it is increased by 10 atmospheres. [1 atm= 1.013 X 10^5 N/m^2]

53. In an experiment, the diameter of rod was 1.26 cm and distance between two knife edges is 0.7 m. On putting a load of 0.9 kg, the midpoint, the depression was 0.025 cm. Find the Young's modulus of elasticity of the material of rod

54. What is the strain of a 2.5 m wire that stretches by 3 mm, if a load is applied?

55. The volume of a solid does not vary with pressure. Find the Poisson's ratio for the solid.

56. What couple must be applied to a wire one meter long, 1 mm in diameter in order to twist one end of it, through 90^0, the other end remaining fixed? Rigidity of the material of wire is 2.8 X 10^{10} N/m^2.

Long Answer Questions

57. A rectangular metal bar is supported at its two ends on knife edges and a load is applied at the middle point. Calculate the depression of middle point.

58. A rectangular metal bar is supported at its two ends on knife edges and a load is applied at the middle point. Obtain the Young's modulus of the bar

59. What is torsional oscillation?

Describe the method of measurement of rigidity by torsional oscillations. Derive the necessary formula

60. What is torsional oscillation? Derive an expression for the modulus of the rigidity

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Chapter-4: Surface Tension

Objective Questions

1. The surface tension of liquid is 0.050 N/m. Find the vertical force required to detach a floating pin of length 2.5 cm from the surface of water

a) 20 N

b) 0.005 N

c) 0.00125 N

d) 0.0025 N

2. Surface tension depends upon

a) contamination of the liquid surface

b) presence of impurity in liquid

c) temperature

d) all of these

3. For the liquid which wets the solid surface, the angle of contact is

a) obtuse

b) acute

c) 90^0

d) 180^0

4. If a glass rod is dipped in mercury and withdrawn out, the mercury does not wet the rod because

a) angle of contact is acute

b) cohesion force is more

c) adhesive force is more

d) density of mercury is more

5. Cohesive force is experienced between

a) magnetic substances

b) molecules of same substances

c) molecules different substances

d) none of these

6. When the temperature is increased the angle of contact of a liquid

a) increases

b) decreases

c) remains the same

d) first increases and then decreases

7. Surface tension is due to

a) frictional forces between molecules

b) adhesive forces between molecules

c) cohesive forces between molecules

d) gravitational forces

8. If the surface tension of a liquid is T, the gain in surface energy for an increase in liquid surface by A is

a) AT^{-1}

b) A^2T

c) AT

d) A^2T^2

9. The value of surface tension of a liquid at critical temperature is

a) zero

b) infinite

c) between 0 and infinity

d) cannot be determined

10. When a drop of water is dropped on oil surface, then

a) it will mix up with oil

b) it spreads in the form of a film

c) it will deform

d) it remains spherical

11. The meniscus of mercury in the capillary tube is

a) convex

b) plane

c) concave

d) uncertain

12. On mixing the salt in water, the surface tension of water will

a) increase

b) decrease

c) remains unchanged

d) none of the above

13. The liquid meniscus in capillary tube will be convex, if the angle of contact is

a) greater than 0^0

b) less than 90^0

c) equal to 90^0

d) equal to 0^0

14. Small droplet of a liquid are usually more spherical in shape than large drops of the same liquid because

a) force of surface tension is equal and opposite to the force of gravity

b) force of gravity predominates the force of surface tension

c) force of surface tension predominates the force of gravity

d) force of gravity and force of surface tension act in the same direction and are equal

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

a) dyne/cm

b) dyne/cm^2

c) erg/cm^2

d) erg/cm

Answer in one sentence

16. Define surface tension and give its unit.

17. What is angle of contact? State under what condition it is zero.

18. When the angle of contact are acute and obtuse.

19. Why washing with warm water is more effective?

20. What is capillarity and capillary?

21. Mention some examples of capillary action

22. Give the important applications of Jaegers method.

Short Notes

23. Write a short note on angle of contact
24. Write a short note on applications of surface tension
25. Write a short note on conical capillary tube
26. Write a short note on adhesive and cohesive force

Short Answer Questions

27. What is surface tension? Give its unit and dimensions
28. Define the angle of contact. State the characteristics of angle of contact
29. Give applications of surface tension
30. State the characteristics of angle of contact.
31. What will be work done in blowing a soap bubble of radius 2 cm? The surface tension of soap solution is 0.035 N/m
32. Find the work done in blowing a soap bubble of 1.6 cm radius. If the surface tension of soap solution is 0.035 N/m
33. Calculate the work done in blowing a soap bubble of radius 5 cm. Surface tension of soap solution is 25 dyne/cm
34. A body floats with 2/3 of its volume above the surface of water. Calculate the density of the body. [Given: Density of water= 10^3 kg/m^3]
35. A glass capillary tube of diameter 0.2 mm is immersed in a liquid of density 10^3 kg/m^3. If the surface tension of the liquid is 0.0235 N/m. Find the height to which the liquid will rise in the capillary tube. Angle of contact is 20^0 and $\cos 20^0 = 0.9396$.
36. Calculate the surface tension of a liquid which rise 50 cm in a circular tube, 0.04 mm in a diameter. Relative density of liquid is 0.8 g/cm3. The angle of contact is 200.
37. The tube of mercury barometer has an internal diameter of 5 mm. How much error does surface tension introduce in the readings? Angle of contact is 128^0 and surface tension is 465 X 10^{-3} N/m.
38. Calculate the work done in breaking a mercury drop of radius 1 mm into one thousand droplets, all the same size. Surface tension of mercury is 0.525 N/m.

39. A glass capillary tube of diameter 0.2 mm is immersed in a liquid of density 725 kg/m^3. If the surface tension of the liquid is 0.0235 N/m. Find the height to which liquid will rise in the capillary tube. Angle of contact is 20^0 and $\cos 20^0 = 0.9396$.

Long Answer Questions

40. Explain various factors affecting the surface tension of a liquid
41. Describe in detail Jaegers method to determine the surface tension of a liquid
42. Explain in detail the capillary rise method for the surface tension of the water
43. What is conical capillary tube? A conical capillary tube ABC with affine bore at A is dipped into water which wets the wall. Calculate the height upto which water will rise

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Chapter-5: Viscosity

Objective Questions

1. The dimensions of coefficient of viscosity is

a) $[M^{-1}L^{-1}T^{-1}]$

b) $[M^{1}L^{-1}T^{-1}]$

c) $[M^{1}L^{-1}T^{1}]$

d) $[M^{1}L^{1}T^{1}]$

2. Usually, the range of Reynolds number for streamlined flow is

a) 300>R>100

b) 1000<R<3000

c) 2000<R<3000

d) R<1000

3. Pressure energy per unit mass of the liquid is given by

a) P/ρ

b) P

c) P/m

d) P/v

4. The equation for continuity for a gas may be written as

a) $A_1V_1= A_2V_2$

b) $A_1 \rho_1= A_2\rho_2$

c) $\rho_1 v_1= \rho_2 v_2$

d) $A_1V_1 \rho_1= A_2V_2 \rho_3$

5. The S.I unit of coefficient of viscosity is

a) poise

b) Newton-second/cm

c) dyne-second/cm^2

d) Newton-second/cm^2

6. Which property measures the resistance of a liquid to flow?

a) density

b) Viscosity

c) volume

d) solubility

7. The buoyant force on an object submerged in a fluid depends on

a) the object density

b) the fluid density

c) the acceleration due to gravity

d) B and C but not A

8. An object is placed in a fluid. The buoyant force on the object is proportional to

a) the density of the object

b) the volume of the object

c) the density of the fluid

d) B and C but not A

9. Oil has a smaller density than water. Therefore, an object that will float in oil will

a) float in water, with more of the object submerged

b) float in water, with the same amount of the object submerged

c) Float in water, with less of the object submerged

d) There is not enough information

10. Which of the following flows is most likely to be turbulent?

a) slow flow in a deep channel

b) fast flow in a deep channel

c) fast flow in a shallow channel

d) slow flow in a shallow channel

11. Viscous force acting tangentially on any liquid layer is directly proportional to

a) distance of the layer from the stationary layer

b) area of the layer

c) thickness of the layer

12. The profile of the advancing liquid in the capillary tube is a

a) parabola

b) hyperbola

c) catenary

13. How does viscosity of a liquid varies with its temperature?

a) viscosity decreases with temperature

b) viscosity increases with temperature

c) viscosity is independent of the temperature

14. How does viscosity of a liquid except water varies with its pressure?

a) viscosity decreases with pressure

b) viscosity increases with pressure

c) viscosity is independent of the pressure

15. How does the viscosity of water varies with its pressure?

a) viscosity decreases with pressure

b) viscosity increases with pressure

c) viscosity is independent of the pressure

Answer in One Sentence

16. What is fluid? Define pressure in a fluid
17. What is viscosity?
18. What is thrust of a fluid?
19. What is meant by one bar of pressure?
20. State Pascal's law
21. Why liquid storage tanks are made thick near the bottom?
22. What is hydrostatic pressure?
23. What is mean by atmospheric pressure?
24. Define the term steady flow
25. What is buoyant force?
26. State Archimedes principle
27. What is the effect of temperature on viscosity of liquid and gases?

Short Notes

28. Write a short note on equation of continuity
29. Write short note on atmospheric pressure
30. Write a short note on Reynolds number
31. Write note on applications of Bernoulli's principle
32. Write note on streamline and turbulent flow

Short answer Questions

33. Define coefficient of viscosity. Give its S.I unit and dimensions

34. State Pascal's law

35. What is meant by atmospheric pressure? Obtain an expression for atmospheric pressure

36. Define streamline and turbulent flow

37. What is critical velocity of liquid? Obtain an expression for Reynolds number. Give its physical significance

38. Obtain the equation of continuity

39. What is the pressure on a swimmer 10 m below the surface of a lake? Given: Pa= 1.013 X 10^5 N/m^2)

40. A metal cube of volume 2.16 X 10^{-4} m^3 and relative density 8 X 10^3 kg/m^3 is suspended by a string, so as to be completely immersed in a liquid of density 1.2 X 10^3 kg/m^3. Find the tension in the string

41. A metal cube of side 6 cm and relative density 8 gm/cm^3 is suspended in a liquid of density 1.2 X 103 kg/m^3. Find the tension in the string

42. Water flowing in a horizontal pipe has speed of 20 cm/s at one end point and 15 cm/s at other point. Determine the pressure drop between two points.

43. Two horizontal pipes of diameters 40 cm and 60 cm are joined together. The speed and pressure of water flowing in the first pipe are 9 m/s and 2 X 10^4 N/m^2. Calculate these quantities in the second pipe. Density of water, $\rho=10^3$ kg /m^3.

Long Answer Questions

44. State and prove Bernoulli's theorem

45. State the working principle of Venturimeter

46. Explain the concept of speed of efflux

47. Obtain an expression for pressure difference between any two points in a liquid accelerating vertically upward with acceleration a0.

48. Obtain an expression for pressure difference between any two points in a liquid accelerating horizontally with acceleration a0.

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