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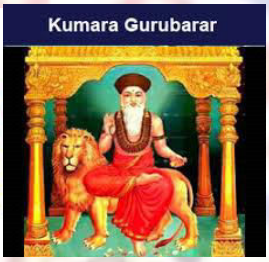

QUESTIONBANK

Title of the Paper

PROPERTIES OF MATTER AND ACOUSTICS

Course:I B.Sc Physics

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CORE COURSE I

PROPERTIES OF MATTER AND ACOUSTICS

Objective: To identify the characteristics of matter in terms their properties and to know the basic principles of acoustics.

UNIT I

Elasticity Hooke's law – Stress-Strain diagram – Factors affecting elasticity- Different moduli of elasticity - Relation between the elastic moduli – Poisson's ratio –- Twisting couple on a cylinder – Determination of rigidity modulus by static torsion – Work done in twisting a wire -Torsional oscillations of a bodyTorsion pendulum - Determination of rigidity modulus and moment of inertia.

UNIT II

Bending of Beams Bending of beams - Expression for bending moment – Cantilever – Expression for depression of the loaded end of a cantilever — Young's modulus by measuring the tilt in a loaded cantilever – Oscillation of a cantilever - Non-uniform bending – Expression for depression- Uniform bending – Expression for elevation – Experimental determination of Young's modulus using pin and microscope method (Non-uniform bending – Uniform bending) - Determination of Young's modulus by Koenig's method.

UNIT III

Surface Tension Definition – Molecular forces – Explanation of surface tension on kinetic theory – Surface energy – Work done on increasing the area of a surface - Angle of contact - Neumann's triangle- Excess pressure inside a liquid drop and soap bubble - Excess pressure inside a curved liquid surface - Force between two plates separated by a thin layer of a liquid - Experimental determination of surface tension - Jaegar's method - Drop- weight method - Capillary rise method - Variation of surface tension with temperature.

UNIT IV

Viscosity Newton's law of viscous flow – streamlined and turbulent motion – Reynold's number - Poiseuille's formula for the flow of a liquid through a horizontal capillary tube – Experimental determination of co-efficient of a liquid by Poiseuille's method - Ostwald's viscometer – Terminal velocity and Stokes' formula - Viscosity of gases – Meyer's formula - Rankine's method - Variation of viscosity with temperature and pressure - Lubrication. Equation of continuity of flow – Euler's equation for unidirectional flow -

Bernoulli's theorem – Filter pump and Wings of aeroplane - Torricelli's theorem - Pitot tube. 5

UNIT V

Acoustics Newton's Formula for velocity of sound –Effect of Temperature, Pressure, Humidity , Density of medium and Wind - Musical Sound and Noise – Speech-Characteristics of Musical sound – Intensity of sound – Measurement of intensity ofsound :Decibel and Phon- Bel. Reverberation – Sabine's Reverberation formula – Factors Affecting the Acoustics of Buildings – Sound distribution in an Auditorium – Requisites for good acoustics – Ultrasonics – Production and detection – Medical applications of Ultrasonic waves – Acoustic Grating.

Books for Study:

1. R. Murugeshan, Properties of matter, S. Chand & Co. Pvt. Ltd., Revised edition, 2012.

2. D.S. Mathur, Elements of Properties of matter, S. Chand & Co. Pvt.Ltd., Revised edition, 2010

3. Brijlal& N. Subramanyam, Properties of matter, VikasPublishng. Pvt. Ltd, 2005.

4. Brijlal& N. Subramanyam, 'A Text Book of Sound', Vikas Publishing. Pvt. Ltd, 2008.

Books for Reference:

1. Feynman, Lectures on Physics. Vol. I & II by Richard P. Feynman, The New Millennium Edition, 2012.

2. David Halliday and Robert Resnick, Fundamentals of Physics by Wiley Plus., 2013.

3. B.H. Flowers and E. Mendoza, Properties of matter, Wiley Plus, 1991.

4. H.R. Gulati, Fundamentals of General properties of matter, S. Chand & Co. Pvt. Ltd, 2012.

5. Chatterjee and Sen Gupta, A treatise on general properties of matter, New central Books agency (p) Ltd, Kolkata, 2001.

6. R.L. Saihgal, A Text Book of Sound, S. Chand & Co. Pvt. Ltd, New Delhi, 1979.

UNIT-I
ELASTICITY

CHOOSE THE CORRECT ANSWER

1. The stress formula is
   a. $\frac{F}{A}$
   b. $\frac{F}{\alpha}$
   c. $\frac{F}{\beta}$
   d. $\frac{F}{\gamma}$

2. The Hooke's law is
   a. $\frac{Force}{Area}$
   b. $\frac{Stress}{Strain}$
   c. $\frac{Stress}{Force}$
   d. $\frac{Force}{Strain}$

3. The young's modulus (E) is
   a. $\frac{FA}{Ll}$
   b. $\frac{Fl}{AL}$
   c. $\frac{FL}{Al}$
   d. $\frac{F}{A}$

4. The Rigidity modulus (G) is
   a. $\frac{Stress}{Strain}$
   b. $\frac{Tangential}{Shearing}$
   c. $\frac{Tangential\ Force}{Shearing\ Force}$
   d. $\frac{Tangential\ stress}{Shearing\ strain}$

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5. The Bulk modulus (K) is
    a. $\frac{Bulk\ Stress}{Bulk\ Strain}$
    b. $\frac{Length}{Force}$
    c. $\frac{Yielding\ Stress}{Ultimate\ Strength}$
    d. $\frac{Bulk\ Strain}{Bulk\ modulus}$

6. The Poisson's ratio(γ)
    a. $\frac{\Delta r/r}{\Delta L/L}$
    b. - $\frac{\Delta r/r}{\Delta L/L}$
    c. $\frac{\Delta A/A}{\Delta C/C}$
    d. - $\frac{\Delta A/A}{\Delta C/C}$

7. The relation between Angle of shear and linear strain is
    a. ϕ=3e
    b. ϕ= $\frac{3e}{2}$
    c. ϕ=2e
    d. ϕ=$\frac{e}{2}$

8. The relation between volume strain and Linear strain is
    a. $\frac{3e}{A}$
    b. $\frac{3e}{2}$
    c. H3e
    d. 3e

9. The work done in Stretching 'A' wire is
    a. $\frac{1}{2}$ stress x strain
    b. $\frac{FAl}{L}$
    c. $\frac{Fl}{L}$
    d. $\frac{\frac{1}{2}FL}{A}$

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10. The work done in twisting ‘A’ wire
    a. w= $\int_0^\theta c d\theta$
    b. w=$\frac{1}{2}c\theta^2$
    c. w=$\frac{1}{3}c\theta^3$
    d. w=$\frac{3}{2}c\theta^2$

ANSWERS:

1) a 2) b 3) c 4) d 5) a 6) b 7) c 8) d 9) a 10) b

TWO MARKS

11. What is elasticity?
12. What is stress?
13. What is strain?
14. Define Hooke’s low.
15. Define yielding stress.
16. Define breaking stress or ultimate strength of the wire?
17. Give the Poisson’s ratio.
18. Define work done in Twisting a wire.
19. Define moment of Inertia of the disc by Torsional oscillations.
20. Define Torsion pendulum.

FIVE MARKS

21. Explain stress-strain diagram.
22. Explain “Young’s modulus (E).
23. Explain Rigidity modulus(G).
24. Explain Bulk modulus (K).
25. Explain Twisting couple on a cylinder.
26. Explain work done in stretching a wire.
27. Explain period of oscillation of a Torsion pendulum.
28. Explain Rigidity modulus Torsion pendulum.
29. Explain factors affecting elasticity.
30. Explain Searle’s apparatus.

TEN MARKS

31. Briefly explain different moduli of Elasticity.
32. Briefly explain relation between the Elastic moduli.
33. Briefly explain Static Torsion method.
34. Briefly explain Static Torsion method.(Searle’s Apparatus-scale and Telescope).

35. Briefly explain Static Torsional oscillations, rigidity modulus, moment of inertia of the disc byTorsional oscillations.
36. Briefly explain relation between Angle of Shear and linear strain.
37. Briefly explain relation between volume strain and linear strain.
38. Briefly explain determination of Poisson's ratio γ for Rubber.
39. Briefly explain expression for couple per unit twist.
40. Briefly explain relation between [E,G and K], [G,K and V], [E,G and V] and [Limits to the value of γ].

UNIT-II
BENDING OF BEAMS

CHOOSE THE CORRECT ANSWER

1. The rectangular cross-section is
   a. $Ig=bd^3/12$
   b. $Ig=bd^2/12$
   c. $Ig=bd^2/3$
   d. $Ig=bd^3/6$

2. The circular cross-section is
   a. $Ig=\pi r^4/4$
   b. $Ig=\pi r^{2/}2$
   c. $Ig=\pi r/2$
   d. $Ig=\pi r^3/3$

3. The young's modulus by Cantilever depression is
   a. $y=wl^3/3EIg$
   b. $y=wl/3EIg$
   c. wl/EIg
   d. wl^3/EIg

4. The oscillations of a Cantilever depressed position is
   a. $w=wl^3/3EAK^2$
   b. $w=4Mgl^3/bd^3y$
   c. $w=wl^3/3yIg$
   d. $w=3EAk^2/l^3xY$

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5. The depression at the mid-point of a beam loaded at the middle is
    a. $A=wl^3/48EIg$
    b. $y=wl^3/EIg$
    c. $A=wl/4EIg$
    d. $A=wl^2/48Ig$
6. The young's modulus of the material of the beam is calculated using the formula is
    a. $E=Mgl/bd^3y$
    b. $E=Mgl^3/12y\pi r^4$
    c. $E=Mgl/bd^3$
    d. $E=Mgl^3/4bd^3y$

7. The young's modulus of the koening's method beam is calculated from the relation is
    a. $E=3Mgl^2(2D+L)/2bd^3s$
    b. $E=Mgl(2D+L)/bd^3s$
    c. $E=3Mgl^2/2bd^3$
    d. $E=Mgl(2D+L)/bd^3s$

8. Uniform bending-experiment for the elevation calculated from the relation is
    a. $y=wal^2/8EIg$
    b. $y=wa/EIg$
    c. $y=wal^3/EIg$
    d. $y=wl^2/8Ig$

9. The experiment to determine the young's modulus using microscope is
    a. Bending moment
    b. Elevation
    c. Depression
    d. Uniform bending

10. The beam supported at its ends and loaded in the middle reaction is
    a. Uniform bending
    b. Bending moment
    c. Elevation
    d. Non-uniform bending

ANSWERS:

1) a 2) a 3) a 4) d 5) a 6) d 7) a 8) a 9) d 10) d

TWO MARKS

11. What is Beam?
12. What is Bending moment?
13. Give the Neutral axis.
14. Define Cantilever.
15. Define linear strain.
16. Define young's modulus.
17. Write the internal bending moment.
18. Define the rectangular cross-section.
19. Define the circular cross-section.
20. Give the geometrical moment of inertia.

FIVE MARKS

21. Briefly explain Bending moment.
22. Explain expression for the Bending moment.
23. Explain young's modulus by Cantilever depression.
24. Explain oscillations of a Cantilever.
25. Explain measurement of young's modulus by Cantilever oscillations.
26. Explain Beam supported at its ends and loaded in the middle.
27. Explain uniform bending-expression for Elevation.
28. Explain I-shape Girders.
29. Explain oscillation of a Cantilever non-uniform bending.
30. Explain oscillation of a Cantilever uniform bending.

TEN MARKS

31. Explain expression for the depression of the loaded end of a Cantilever.
32. Explain measuring the tilt in a loaded Cantilever.
33. Explain depression at the mid-point of a beam loaded at the middle.
34. Explain experiment to determine young's modulus by Koenig's method.
35. Explain experiment to determine young's modulus using Microscope.
36. Explain experiment to determine young's modulus using Pin and Microscope method Non-uniform bending.
37. Explain experiment to determine young's modulus using Pin and Microscope method Uniform bending.
38. Explain expression for depression uniform bending.
39. Explain expression for depression non-uniform bending.
40. Explain experiment to determine young's modulus by Scale and a telescope method.

UNIT-III
SURFACE TENSION

CHOOSE THE CORRECT ANSWER

1. The molecule is attracted by all other molecules within
    a. Neighbouring molecules
    b. Molecular range
    c. Cohesion molecules
    d. Sphere of influence

2. The direction of the force is tangential to the surface and perpendicular to the line is
    a. Surface tension=$\frac{Force}{Length}$
    b. Surface tension=$\frac{F}{g}$
    c. Surface tension=mg
    d. Surface tension=$\frac{F}{A}$

3. The dimensions of Surface tension are
    a. MT^{-1}
    b. MT^{-3}
    c. MT^{-2}
    d. MT^{4}

4. For a given volume the surface area of a
    a. Sphere is maximum
    b. Sphere is minimum
    c. Sphere is solid
    d. Sphere is lead

5. The falling rain drops are spherical in shape due to
    a. Surface soap film
    b. Surface metal ring
    c. Surface Tension
    d. Surface water

6. The liquid surface is plane, the resultant force of surface tension on a molecule is
    a. 10
    b. 20
    c. 0
    d. 5

7. The liquid surface is____ the resultant force is outward.
    a. Mirror
    b. Plane glass
    c. Concave
    d. Convex

8. The excess pressure inside a soap Bubble is
    a. $p=\frac{\sigma}{r}$
    b. $4\pi r\sigma$
    c. $p=\frac{4\sigma}{r}$
    d. $p=\frac{2\sigma}{r}$

9. The surface is called an anticlastic surface in this case general relation is
    a. $p=\sigma(1/R_1-1/R_2)$
    b. $p=\sigma(1/R_1\pm1/R_2)$
    c. $p=\sigma(1/R_1+1/R_2)$
    d. $p=\sigma(1/R_1-1/R)$

10. The S.T. of an unassociated liquid is found to decrease with rise to temperature, according to the formula is
    a. $\sigma_t=\sigma_0(1-\alpha t)$
    b. $\sigma(Mv_x)^{3/2}=k(\theta_c-\theta-d)$
    c. $\sigma=\frac{1}{2}rg(h_1\rho_1-h_2\rho_2)$
    d. $\sigma=(h_1\rho_1-h_2\rho_2)g$

ANSWERS:

1) d 2) a 3) c 4) b 5) c 6) c 7) d 8) c 9) b 10) a

TWO MARKS

11. Define Surface tension.
12. What is definition of Surface tension?
13. Give unit of Surface tension.
14. Write the dimensions of Surface tension.
15. Give the Cohesive force.
16. What is Adhesive force?
17. Define sphere of influence is well within the liquid.
18. Define resultant downward force acting on B.
19. What is Surface film?
20. What is stretched Elastic membrane?

FIVE MARKS

21. Explain Cohesive forces Adhesive forces.
22. Explanation of surface tension on kinetic theory.
23. Explain pressure difference across a liquid surface.
24. Explain excess pressure inside a liquid drop.
25. Explain excess pressure inside a soap bubble.
26. Explain excess pressure inside any particular surface.
27. Explain Anticlastic surface.
28. Explain surface tension at different temperature.
29. Explain advantages of the surface tension.
30. Explain drawback of the surface tension.

TEN MARKS

31. Briefly explain work done on increasing the area of a surface.
32. Briefly explain Neumann's triangle.
33. Briefly explain excess pressure inside a liquid drop and soap bubble.
34. Briefly explain excess pressure inside a curved liquid surface.
35. Briefly explain force between two plates separated by a thin layer of a liquid.
36. Explain experimental determination of surface tension.
37. Briefly explain Jaeger's method.
38. Briefly explain Drop weight method.
39. Briefly explain Capillary rise method.
40. Briefly explain variation of surface tension with temperature.

UNIT- IV
VISCOSITY

CHOOSE THE CORRECT ANSWER

1. The hydrostatic pressure at any point inside the liquid is given by
    a. p=hg
    b. p=ρg
    c. p=hρg
    d. p=mh

2. The stream line motion and rate of flow is
    a. Area of cross-section X velocity of flow
    b. Rectangular cross-section X velocity of flow
    c. Circular cross-section X velocity of flow
    d. Horizontal cross-section X velocity of flow

3. According to Reynold, the critical velocity of a liquid is given by
    a. $V_c=\eta/D$
    b. $V_c=R/\rho$
    c. $V_c=R/D$
    d. $V_c=R\eta/\rho D$

4. The equation of continuity is
    a. $a_1v_2=a_2v_2$
    b. $a_1v_1=a_2v_2$
    c. av=constant
    d. $a_1a_2=v_1v_2$

5. The total energy per unit mass of the liquid at any point is given by
    a. $V^2/2+gh+P/\rho$
    b. $V/2+gh+P/\rho$
    c. $V^2/2+h+P/\rho$
    d. $V/4+gh+P/\rho$

6. The filter pump is used to__ the process of Filtration of liquids is
    a. Slow process
    b. Middle process
    c. Quickened process
    d. High process
7. The upper surface is made Convex and the Lower surface is
    a. Convex
    b. Concave
    c. Plane lenses
    d. Quartz lenses

8. The property by virtue of which a liquid opposes the relative motion between the different layers is
    a. Viscosity
    b. Friction
    c. Stationary
    d. External force

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9. The Stoke's law is
    a. $\eta=2r^2(p-\sigma)g/qv$
    b. $\eta =2r^2g/9v$
    c. $\eta =p-\sigma/9v$
    d. $r^2(p-\sigma)g/9v$

10. The significance of Reynold's number is
    a. $k=V_c/\eta$
    b. $k=V_c\rho r/\eta$
    c. $k=\rho r/\eta$
    d. $k=V_c\rho/\eta$

ANSWERS:

1) c 2) a 3) d 4) b 5) a 6) c 7) b 8) a 9) a 10) b

TWO MARKS

11. What is viscosity?
12. Give the velocity gradient.
13. Give the definition of viscosity.
14. What is correction for pressure head?
15. What is correction for length of tube?
16. Give the Lubrication.
17. Define Damping of instruments.
18. Define Newton's law of viscous flow.
19. Define filter pump.
20. Define Pitot tube.

FIVE MARKS

21. Explain Reynold's number.
22. Explain corrections to poiseuille's formula.
23. Explain variation of viscosity with Temperature and pressure.
24. Explain Lubrication.
25. Explain applications of viscosity.
26. Explain equation of continuity of flow.
27. Explain Euler's equation for unidirectional flow.
28. Explain Bernoulli's theorem.
29. Explain the wings of an Aeroplane.
30. Explain Torricell's theorem.

TEN MARKS

31. Briefly explain derivation of poiseuille's formula.
32. Briefly explain poiseuille's method or determination of coefficient of viscosity of a liquid.
33. Briefly explainpoiseuille's method or determination of coefficient of viscosity of a liquid.[variable pressure head]
34. Briefly explain rate of flow of liquid in a capillary Tube-poiseuille's formula.[method of dimensions]
35. Briefly explain study of the variation of viscosity of a liquid (water) with Temperature.
36. Briefly explain streamline flow and Turbulent flow.
37. Briefly explain Ostwald's viscometer.
38. Briefly explain Terminal velocity and stoke's formula.
39. Briefly explain viscosity of gases Meyer's formula.
40. Briefly explain Rankine's method

UNIT- V
ACOUSTICS

CHOOSE THE CORRECT ANSWER

1. The intensity of sound the area being perpendicular to the direction of
    a. Frequency of the sound
    b. Velocity of the sound
    c. Propagation of sound
    d. Density of the sound
2. The equation of a simple harmonic wave is
    a. y=a sin ω(t-x/v)
    b. y=sin ω(t-x^2/v^2)
    c. y= sin ω^2(t^2-x^2/v^2)
    d. y= a^2(t^2-x^2/v^2)

3. The expression for the intensity of sound in terms of pressure Amplitude.
    a. $I = 2\pi^2\rho n^2 a^2 v$
    b. $I = \frac{(2\pi a\rho vn)^2}{2\rho v}$
    c. $I = \frac{p^2 max}{2\rho v}$
    d. I=2πan

4. The measurement of intensity of sound-decibel andbel this standard intensity is
    a. Standard of intensity
    b. Ratio of intensity
    c. Increase in intensity
    d. Change in intensity

5. The prevention of the transmission of noise inside or outside the hall is
    a. Sound insulation
    b. Sound efficiency
    c. Sound irritation
    d. Sound damaged

6. Ultrasonic waves are also travel with the speed of sound is
    a. 300 ms^{-1}
    b. 310 ms^{-1}
    c. 330 ms^{-1}
    d. 320 ms^{-1}

7. The relation between velocity(v), frequency(n) and Wavelength(λ) is
    a. λ=v/n
    b. n=v/λ
    c. v=nλ
    d. n=λ/v
8. The electric charge developed is proportional to the amount of pressure or tension. This phenomenon is
    a. Electric effect
    b. Piezoelectric effect
    c. Magnetic effect
    d. Gravity effect

9. The Sabine's formula for reverberation time is
    a. $\left(\frac{A\propto v}{4V}\right) T = log_e 10^6$
    b. $\sigma=\sigma_{max} e^{-\left(\frac{A\propto v}{4V}\right)t}$
    c. $T = \frac{0.158V}{A\propto}$
    d. $T = \frac{0.158V}{\sum A\propto}$

10. The noise which is produced inside the hall is
    a. Extraneous noise
    b. Inside noise
    c. Airborne noise
    d. Structure borne noise

ANSWERS:

1) c 2) a 3) c 4) a 5) a 6) c 7) c 8) b 9) d 10) b

TWO MARKS

11. Give the Intensity of sound.
12. What is expression for the Intensity of sound?
13. Define derivation of Intensity of sound.
14. Write expression for Intensity of sound in terms of pressure Amplitude.
15. What is threshold of Audibility?
16. Give the definition of Bel.
17. Define Decibel.
18. Define loudness of sound.
19. Give the distinction between loudness and Intensity of sound.
20. Define Noise pollution.

FIVE MARKS

21. Drive Newton's formula for velocity of sound.
22. Define the effect of temperature.
23. Discuss the pressure.
24. Discuss the Humidity.
25. Define density of medium and wind.
26. Define musical sound and noise.
27. Discuss speech and characteristics of musical sound.
28. Discuss Intensity of sound.
29. Derive measurement of Intensity of sound.
30. Discuss Decibel and phon+bel.

TEN MARKS

31. Briefly explain Reverberation.
32. Briefly explain Sabine's Reverberation formula.
33. Briefly explain factors affecting.
34. Briefly explain Acoustics of building.
35. Briefly explain sound distribution in an Auditorium.
36. Discuss the requisites for good Acoustics.
37. Discuss the Ultrasonic.
38. Discuss the production and detection.
39. Discuss the medical applications of ultrasonic waves.
40. Discuss the Acoustic grating.