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Corporate Office: # 100-102, Ram Nagar, Bambala Puliya, Toll Tax,
Tonk Road, Pratap Nagar, Jaipur (Rajasthan)-302033
E-Mail : engineers.academy.india@gmail.com
Website : www.engineersacademy.org
Helpline Number : +91 8094441777

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Preface

This book has been written to meet the growing requirements of candidates appearing for State Engineering Service Examination, Junior Engineer, Public Sector Units, RRB-JE and Metro Exams. Though every candidate has ability to succeed but competitive environment, in-depth knowledge, quality guidance, time management and good source of study is required to achieve goals.

This book includes Multiple Choice Questions (MCQ Volume-I) which works as a mock exam practice for the reader. Questions of all the subject have been organized in systematic, concepts oriented and error less manner so that it become easy and interesting for even a beginner to understand. It is a very convenient book and must be solved by candidate aiming for competitive exams.

After solving this booklet students can feel encouraged and develop confidence to attempt each and every type of numerical as well as theoretical problems. Each problems explains solving approach so that at the end, so the reader is well equipped to be able to apply any type of problem solving requirement and distinctly choose one strategy or type from the other.

We hope this book will be proved an important tool to succeed in State Engineering Service Examination, Junior Engineer, Public Sector Units, RRB-JE and Metro Exams.

It is earnestly hoped that with the extensive additions and revisions, the present edition will facilitate the students not only in preparing themselves for competitive examinations but also in preparing for their regular examinations and prove more useful to the students than the earlier editions.

Even though, enough readings were given for correcting the error and printing mistakes, due to human tendency there could be some minor typos in the book. If any such typos found, they will be highly appreciated and incorporated in the next edition. Also, please provide your valuable suggestions at :engineers.academy.india@gmail.com

All the Best!

Engineers Academy Editorial Board

CONTENTS

UNIT-I

FLUID MECHANICS

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CHAPTER 1

PROPERTIES OF FLUIDS

OBJECTIVE QUESTIONS

1. An ideal fluid

(a) Is very viscous

(b) Obeys newton's law of viscosity

(c) Is assumed in conduit flow

(d) Frictionless and incompressible

[RPSC]

2. The density of air at 10°C is 1 MPa abs. in SI units is

(a) 12.31 (b) 1.231

(c) 118.4 (d) 65.0

3. The viscosity of a fluid varies with

(a) Temperature

(b) Temperature and pressure

(c) Pressure

(d) Density

4. A fluid is a substance that

(a) Is essentially incompressible

(b) Always moves when subjected to a shearing stress

(c) Has a viscosity that always increases with temperature

(d) Has a viscosity that always decreases with temperature

5. With decrease in temperature, the viscosity in gases generally

(a) Increases linearly

(b) Increases exponentially

(c) Remain unaffected

(d) Decreases

6. Viscosity of a fluid with specific gravity 1.3 is measured to be 0.0034 Ns/m^2. Its kinematic viscosity, in m^2/s, is

(a) 2.6×10^{-6} (b) 4.4×10^{-6}

(c) 5.8×10^{-6} (d) 7.2×10^{-6}

7. Viscosity is the most important property in the

(a) Travel of a bullet through air

(b) Water jet issuing from a fire air

(c) Formation of soap bubbles

(d) Flow of castor oil through a tube

8. If the mass density of a liquid is 1000 kg/cum and its dynamic viscosity is 1 Ns/sq.m, then its kinematic viscosity (sq.m/s) will be :

(a) 0.1 (b) 1

(c) 0.001 (d) 0.01

[DDA JE - 2018]

9. A fluid in which resistance to deformation is linerly dependent of the shear stress, is known as

(a) Bingham plastic fluid

(b) Pseudo plastic fluid

(c) Dilatant fluid

(d) Newtonian fluid

10. Which of the following is not dimensionless quantity?

(a) Specific gravity

(b) Pressure coefficient

(c) Darcy weisbach friction factor

(d) Kinematic viscosity

11. One poise is equivalent to

(a) 360 kg/m-hr (b) 1 dyne sec/cm^2

(c) 10^{-1} kg./m-sec (d) All the above

12. In a flowing fluid, a particles may posses

(a) Inertial energy

(b) Pressure energy

(c) Kinetic energy

(d) All of the above

13. When the reheogram for a fluid at any temperature and pressure is a straight line passing through origin, the fluid is said to be

(a) Ideal plastic (b) Bingham

(c) Newtonian (d) Non-newtonian

14. A pressure of 500 kPa applied to 2m^3 of liquid results in a volume change of 0.004 m^3. The bulk modulus, in MPa, is

(a) 2.5 (b) 25

(c) 250 (d) 2500

15. SI unit of kinematic viscosity is : –

(a) N.s/m^2 (b) m^2/s

(c) N/m (d) N.s/m

[RPSC-VPITI, Haryana JE, ISRO - 2018]

16. A fluid, which satisfies the relations 'τ' = μ (du/dy), where 'τ' is shear stress,

μ constant of proportionality and (du/dy) is the rate of deformation, is known as : –

(a) Newtonian fluid

(b) Non – Newtonian fluid

(c) Thixotropic fluid/ substance

(d) Plastic

[RPSC-VPITI]

17. Which of the following fluids can be classified as non-newtonian ?

(a) Kerosene oil and Diesel oil

(b) Human blood and Toothpaste

(c) Diesel oil and water

(d) Kerosene oil and water

[LMRC-JE]

18. Which of the following fluid is incompressible and is having no viscosity?

(a) Real fluid (b) Non-Newtonian fluid

(c) Ideal fluid (d) Newtonian fluid

[PEB-SUB ER. - 2017, Haryana JE - 2018]

19. Poise is a unit for which of the following?

(a) Specific volume

(b) Viscosity

(c) Kinematic viscosity

(d) Mass density

[PEB-SUB ER. - 2017]

20. Specific gravity is also called as ___.

(a) Relative density (b) Mass density

(c) Specific weight (d) Weight density

[PEB-SUB ER. - 2017]

21. In CGS system, the unit of kinematic viscosity is stoke, where 1 stoke = ___.

(a) 10^6cm^3/s (b) 10^{-2}m^2

(c) 10^4cm^3/s (d) 10^{-4}m^2/s

[PEB-SUB ER. - 2017]

22. The ratio of the mass of a fluid to its volume is known as ___.

(a) Mass density (b) Viscosity

(c) Specific weight (d) Weight density

[PEB-SUB ER. - 2017]

23. Dynamic viscosity (μ) has the dimension as :

(a) MLT^{-2} (b) $ML^{-1}T^{-1}$

(c) $ML^{-1}T^{-2}$ (d) $M^{-1}L^{-1}T^{-1}$

[MPSC - 2012, AEC - 2017]

24. A fluid in equilibrium cannot sustain:

(a) tensile stress (b) compressive stress

(c) shear stress (d) bending stress

[ISRO - 2015, NHPC - 2013]

25. One kilo Pascal is equivalent to :

(a) 10 N/mm^2 (b) 1000 N/m^2

(c) 100 N/mm^2 (d) 1000 N/cm^2

[NBCC - 2017]

26. Fluids undergo volume change under external pressure due to

(a) Plasticity (b) Viscosity

(c) Tenacity (d) Compressibility

[ISRO - 2018]

27. 1 centipoise = _____ poise.

(a) 1/10 (b) 1/100

(c) 1/50 (d) 1/25

[Haryana JE - 2018]

28. The viscosity of water at 20°C is

(a) 0.05 poise (b) 0.1 poise

(c) 0.01 poise (d) 0.1 centipoise

[Haryana JE - 2018]

29. A vessel of 4 m^3 contains oil which weight 30 kN. The specific weight of the oil is

(a) 4.5 kN/m^3 (b) 6 kN/m^3

(c) 7.5 kN/m^3 (d) 10 kN/m^3

[ISRO - 2017]

30. The variation in the volume of a liquid with the variation of pressure is called its

(a) Surface tension (b) Compressibility

(c) Capillarity (d) Viscosity

[ISRO - 2017]

31. Newton's law of viscosity is a relationship between

(a) Pressure, velocity and temperature

(b) Shear stress and rate of shear strain

(c) Shear stress and velocity

(d) Rate of shear strain and temperature

[ISRO - 2017]

32. Pascal-sec is the unit of

(a) Pressure (b) Kinematic viscosity

(c) Dynamic viscosity (d) Surface tension

[PMB JE - 2018]

33. If the volume of a liquid weighing 3000 kg is 4 cubic meters, 0.75 is its

(a) Specific weight (b) Specific mass

(c) Specific gravity (d) Specific volume

[ISRO - 2013]

34. The property of a fluid which offers resistance to the movement of one layer to another adjacent layer is called ___.

(a) Viscosity (b) Slip

(c) Opacity (d) Velocity

[DMRC - 2018]

35. When a matter resists applied shear stress by static deformation, it is :

(a) Liquid (b) Gas

(c) Fluid (d) Solid

[DDA JE - 2018]

36. Surface tension has the dimensions

(a) FL^{-1} (b) F

(c) FL^{-2} (d) FL^{-3}

[UK Combined AE - 2012, SSC JE - 2011]

37. If salt is added in water, the surface tension of water will :

(a) Increase (b) Decrease

(c) Will not change (d) None of the above

[UPSSSC JE - 2015]

38. The weight per unit volume of a liquid at standard temperature and pressure is called :

(a) Specific weight (b) Specific mass

(c) Mass density (d) Specific gravity

[F.C.I. JE - 2015]

39. Surface tension of water

(a) Increases with decreases in temperature

(b) Decreases with decreases in temperature

(c) Independent of temperature

(d) None of these

[MP SUB Eng. - 2016]

40. The stress, which is responsible for retaining water in a capillary tube above the free water surface of the water body in which the capillary tube is inserted, is called the

(a) Capillary compression

(b) Capillary tension

(c) Capillary pore pressure

(d) None of these

[MP SUB Eng. - 2016]

112. ***Ans. (a)***

$$P = \frac{8\sigma}{d}$$

$$= \frac{8 \times 0.0125}{2.5} \times 1000 \text{ mm}$$

$$d = 40 \text{ mm}$$

113. ***Ans. (a)***

Coefficient of Compressibility

$$= \frac{1}{\text{Bulk Modulus}}$$

$$\text{Bulk Modulus (K)} = \frac{\Delta P}{\left(-\frac{\Delta V}{V}\right)}$$

$$= \frac{(15 - 7.5) \times 10^6}{-\left(-\frac{0.2}{100}\right)}$$

$$K = 3750 \times 10^6 \text{ N/m}^2$$

$$\beta = \frac{1}{K} = \frac{1}{3750 \times 10^6}$$

$$= \frac{1}{3.75} \times 10^{-9}$$

$$= 0.267 \times 10^{-9} \text{ m}^2/\text{N}$$

114. ***Ans. (b)***

$$\beta = 0.75 \times 10^{-9} \text{ m}^2/\text{N}$$

$$V = 0.01 \text{ m}^3$$

$$\Delta P = 2 \times 10^7$$

$$\beta = -\frac{\frac{\Delta P}{\Delta V}}{V}$$

$$= \frac{-\frac{\Delta V}{V}}{dP}$$

$$\beta = +\frac{\Delta V}{V \Delta P}$$

$$0.75 \times 10^{-9} \times 0.01 \times 2 \times 10^7 = \Delta V$$

$$\Delta V = 1.5 \times 10^{-4} \text{ m}^3$$

115. ***Ans. (d)***

116. ***Ans. (a)***

117. ***Ans. (b)***

$$\gamma = \frac{\mu}{\rho}$$

$$= T\uparrow, \mu\uparrow, \rho\uparrow, \gamma\uparrow$$

118. ***Ans. (c)***

$$\Delta P = \frac{4\sigma}{d}$$

$$= \frac{4 \times 0.075}{0.075 \times 10^{-3}}$$

$$= 4000 \text{ N/m}^2$$

$$= 4000 \times \frac{N}{10^4 \text{cm}^2}$$

$$= 0.4 \text{ N/cm}^2$$

119. ***Ans. (a)***

120. ***Ans. (c)***

$$\gamma = \frac{\mu}{\rho} = \frac{0.7}{0.8} = 0.87 \text{ stoke}$$

121. ***Ans. (b)***

122. ***Ans. (d)***

Dynamic viscosity (μ)

SI unit is pascal-second or N-sec/m^2

CGS-unit is poise = Dyne-sec/cm^2

1 poise = 0.1N-S/m^2

123. ***Ans. (d)***

$$\text{Kinematic viscosity } (v) = \frac{\mu}{\rho}$$

$$= \frac{2}{0.8 \times 1000 \times 10}$$

$$v = 2.5 \text{ stokes}$$

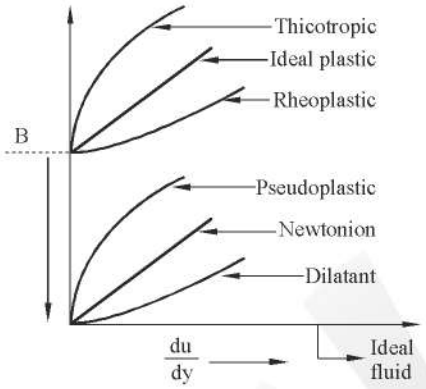
Its SI unit is m^2/sec CGS unit is cm^2/sec or stoke

$$1 \text{ stoke} = 10^{-4} \text{m}^2/\text{sec}$$

124. ***Ans. (a)***

$$t = A\left(\frac{du}{dy}\right)^n + B$$

For non newtonian fluids A & B are constants depending upon type of fluid and condition of flow



125. ***Ans. (c)***

Shear stress $\tau = \mu\left(\frac{dv}{dy}\right)$

Where μ = dynamic viscosity

$\frac{dv}{dy}$ = rate of shear strain or velocity gradient or rate of angular deformation

126. ***Ans. (c)***

$\Delta P = 8\sigma/d$

$\Delta P = 8\times0.09/0.03$

$= 24\ N/m^2$

127. ***Ans. (d)***

128. ***Ans. (a)***

$Pv = \text{constant}$

$$p = \frac{\partial p}{\left(-\frac{\partial \forall}{\forall}\right)} \qquad \boxed{K_{\text{is otherwal}} = P}$$

❑❑❑

28. *Ans. (b)*

29. *Ans. (c)*

30. *Ans. (c)*

31. *Ans. (d)*

32. *Ans. (a)*

33. *Ans. (c)*

34. *Ans. (c)*

35. *Ans. (c)*

36. *Ans. (d)*

37. *Ans. (a)*

38. *Ans. (b)*

39. *Ans. (d)*

40. *Ans. (b)*

41. *Ans. (d)*

$$Q \propto H^{5/2}$$

$$\frac{Q_1}{Q_2} = \left(\frac{H_1}{H_2}\right)^{5/2}$$

$$\frac{Q_1}{Q_2} = \left(\frac{H_1}{4H_1}\right)^{5/2}$$

$$Q_2 = 32Q_1$$

42. *Ans. (c)*

43. *Ans. (d)*

For V-notches

$$\frac{Q_1}{Q_2} = \frac{H_1^{5/2}}{H_2^{5/2}}$$

For rectangular

$$\frac{Q_1}{Q_2} = \frac{H_1^{3/2}}{H_2^{3/2}}$$

Then $$\frac{Q_1}{Q_2} = \left(\frac{0.15}{0.30}\right)^{5/2}$$

$$Q_1 = \left(\frac{1}{2}\right)^{5/2} Q_2$$

44. *Ans. (b)*

Sharp crested weirs used for small flows.

45. *Ans.(c)*

For tri-angular

$$Q = \frac{8}{15} C_d \sqrt{2g} H^{5/2} \tan\frac{\theta}{2}$$

For rectangular

$$Q = \frac{2}{3} C_d B \sqrt{2g} H^{3/2}$$

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