PHYSICS MCQ BOOKLET

Grade 11 · Chapter 6 · Fluid Mechanics

FBISE / National Book Foundation Model Textbook companion

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Independent MCQs on upthrust, Archimedes, viscosity, Stokes law, terminal velocity, continuity, Bernoulli, Torricelli, Venturi, aerofoil, Magnus effect, and superfluidity. Not copied from the book exercise. Total: 108 questions. Each item has four options, the correct letter, and a short explanation of why it is correct.

A. Important / Main Topics

1. Upthrust (buoyant force) on a body in a fluid equals:

(A) the weight of the fluid displaced
(B) the weight of the body
(C) the volume of the body
(D) atmospheric pressure times area always

Correct Answer: A

Explanation: Upthrust (buoyant force) on a body in a fluid equals the weight of the fluid displaced.

2. Archimedes' principle applies to a body that is:

(A) only floating
(B) partly or fully immersed in a fluid
(C) only sinking
(D) in vacuum only

Correct Answer: B

Explanation: Archimedes' principle applies to a body that is partly or fully immersed in a fluid.

3. The SI unit of upthrust is the:

(A) pascal
(B) poise
(C) newton
(D) kg m^-3

Correct Answer: C

Explanation: Upthrust is a force, so its SI unit is the newton.

4. Upthrust on a fully immersed body acts:

(A) downward through the geometric centre of the solid always
(B) horizontally on one face only
(C) only if the body is floating
(D) upward through the centre of buoyancy

Correct Answer: D

Explanation: The line of action is through the centre of mass of the displaced fluid.

5. Apparent weight of a fully immersed body is:

(A) true weight minus upthrust
(B) true weight plus upthrust
(C) upthrust only
(D) zero in every liquid

Correct Answer: A

Explanation: Apparent weight of a fully immersed body is true weight minus upthrust.

6. A 10 cm cube fully immersed in water (rho = 1000 kg/m^3, g = 9.8) has upthrust about:

(A) 0.98 N
(B) 9.8 N
(C) 98 N

(D) 980 N

Correct Answer: B

Explanation: V = 0.001 m^3 so U = 1000 x 0.001 x 9.8 = 9.8 N.

7. A body floats when:

(A) upthrust is less than its weight
(B) its density exceeds the fluid
(C) upthrust equals its weight
(D) volume of the body is zero

Correct Answer: C

Explanation: A body floats when upthrust equals its weight.

8. A solid sinks in a liquid if its average density is:

(A) less than the liquid
(B) equal to the liquid
(C) exactly 1000 kg/m^3 always
(D) greater than the liquid

Correct Answer: D

Explanation: If weight exceeds the maximum upthrust, net force is downward.

9. Neutral buoyancy (hovering fully immersed) occurs when:

(A) density of the body equals density of the fluid
(B) volume is a maximum
(C) upthrust is zero
(D) viscosity is infinite

Correct Answer: A

Explanation: Neutral buoyancy (hovering fully immersed) occurs when density of the body equals density of the fluid.

10. A steel ship floats because:

(A) steel is less dense than water
(B) average density including air-filled hull is less than water
(C) gravity is weaker at sea
(D) upthrust on steel is infinite

Correct Answer: B

Explanation: A steel ship floats because average density including air-filled hull is less than water.

11. A submarine dives mainly by:

(A) heating the hull until steel expands
(B) reducing the mass of steel plates
(C) taking water into ballast tanks to raise average density
(D) switching off viscosity

Correct Answer: C

Explanation: A submarine dives mainly by taking water into ballast tanks to raise average density.

12. To surface, a submarine typically:

(A) adds more ballast water
(B) must melt the hull
(C) relies on Magnus lift only
(D) pumps water out of ballast tanks

Correct Answer: D

Explanation: Emptying tanks lowers average density below that of seawater.

13. The immersed fraction of a floating body equals:

(A) rho_body / rho_fluid
(B) rho_fluid / rho_body

(C) g / rho_fluid
(D) volume divided by mass squared

Correct Answer: A

Explanation: The immersed fraction of a floating body equals rho_body / rho_fluid.

14. Ice of density 917 kg/m^3 floating in water has immersed fraction about:

(A) 0.50
(B) 0.92
(C) 0.10
(D) 1.00

Correct Answer: B

Explanation: 917/1000 is about 0.92, so most of the iceberg is underwater.

15. Wood of density 800 kg/m^3 floating in water has immersed fraction:

(A) 0.20
(B) 1.00
(C) 0.80
(D) 0.08

Correct Answer: C

Explanation: 800/1000 = 0.80 of its volume is below the waterline.

16. A 5 N metal object in water has upthrust 2 N. Apparent weight is:

(A) 7 N
(B) 5 N
(C) 2 N
(D) 3 N

Correct Answer: D

Explanation: A 5 N metal object in water has upthrust 2 N. Apparent weight is 3 N.

17. Centre of buoyancy is the:

(A) centre of gravity of the displaced fluid
(B) highest point on the hull
(C) centre of the Earth
(D) metacentre by definition

Correct Answer: A

Explanation: Buoyant force acts through that centre of displaced fluid.

18. A helium balloon rises because:

(A) helium has negative mass
(B) weight of displaced air exceeds the balloon's weight
(C) air has zero viscosity
(D) Bernoulli forbids descent

Correct Answer: B

Explanation: Net force is upthrust minus weight, which is positive.

19. When ice floating in a full glass melts, the water level:

(A) rises over the rim a lot
(B) falls to empty
(C) stays essentially the same
(D) doubles

Correct Answer: C

Explanation: When ice floating in a full glass melts, the water level stays essentially the same.

20. Viscosity measures a fluid's:

(A) weight when displaced
(B) speed of sound

(C) absolute temperature only
(D) resistance to shear or flow

Correct Answer: D

Explanation: Internal friction between fluid layers is viscosity.

21. The SI unit of coefficient of viscosity eta is:

(A) N s m^-2 (Pa s)
(B) newton only
(C) pascal
(D) kg m^-3

Correct Answer: A

Explanation: The SI unit of coefficient of viscosity eta is N s m^-2 (Pa s).

22. 1 Pa s equals how many poise?

(A) 1
(B) 10
(C) 0.1
(D) 100

Correct Answer: B

Explanation: 1 poise = 0.1 Pa s, so 1 Pa s = 10 poise.

23. An ideal fluid is modelled as:

(A) highly viscous and compressible
(B) always turbulent
(C) incompressible and non-viscous
(D) a rigid solid

Correct Answer: C

Explanation: An ideal fluid is modelled as incompressible and non-viscous.

24. Coefficient of viscosity of an ideal fluid is:

(A) infinite
(B) equal to density
(C) 9.8 Pa s
(D) zero

Correct Answer: D

Explanation: Coefficient of viscosity of an ideal fluid is zero.

25. Stokes' law for viscous drag on a small sphere is:

(A) F = 6 pi eta r v
(B) F = 4 pi r^2
(C) F = (1/2) C_d rho A v^2 always
(D) F = m g only

Correct Answer: A

Explanation: Stokes' law for viscous drag on a small sphere is F = 6 pi eta r v.

26. Stokes' law is valid mainly for:

(A) supersonic jets
(B) laminar flow past a small sphere
(C) any turbulent river
(D) ideal fluids with eta = 0

Correct Answer: B

Explanation: Stokes' law is valid mainly for laminar flow past a small sphere.

27. Viscous drag in Stokes' law is proportional to:

(A) v squared only
(B) g only

(C) radius and speed (linear in v)
(D) mass only

Correct Answer: C

Explanation: F grows with r and with v, not with v squared.

28. Neglecting buoyancy, terminal speed of a sphere is:

(A) v_t = 6 pi eta r
(B) v_t = sqrt(2 g h)
(C) v_t = A v
(D) v_t = 2 rho g r^2 / (9 eta)

Correct Answer: D

Explanation: Neglecting buoyancy, terminal speed of a sphere is v_t = 2 rho g r^2 / (9 eta).

29. Terminal velocity of a sphere is proportional to:

(A) r^2
(B) r
(C) 1/r
(D) r^3

Correct Answer: A

Explanation: v_t = 2 rho g r^2 / (9 eta) so v_t scales as r squared.

30. If a raindrop's radius doubles, terminal speed becomes:

(A) twice
(B) four times
(C) half
(D) eight times

Correct Answer: B

Explanation: If a raindrop's radius doubles, terminal speed becomes four times.

31. If viscosity of the medium doubles, terminal speed:

(A) doubles
(B) is unchanged
(C) halves
(D) becomes four times

Correct Answer: C

Explanation: v_t is inversely proportional to eta.

32. A denser sphere of the same size in the same fluid has:

(A) smaller terminal velocity
(B) the same v_t always
(C) zero v_t
(D) larger terminal velocity

Correct Answer: D

Explanation: v_t increases with density rho in 2 rho g r^2 / (9 eta).

33. At terminal velocity the net force on the sphere is:

(A) zero (forces balance)
(B) equal to its weight
(C) equal to Stokes drag alone
(D) infinite

Correct Answer: A

Explanation: Acceleration is zero, so the vector sum of forces is zero.

34. Including buoyancy, weight at terminal speed equals:

(A) viscous drag only, always
(B) upthrust plus viscous drag

(C) upthrust only
(D) zero

Correct Answer: B

Explanation: Including buoyancy, weight at terminal speed equals upthrust plus viscous drag.

35. Laminar flow is:

(A) chaotic with large eddies
(B) always faster than sound
(C) smooth layered motion, typically at low speed
(D) flow with zero density

Correct Answer: C

Explanation: Laminar flow is smooth layered motion, typically at low speed.

36. Turbulent flow is characterized by:

(A) layers that never mix
(B) zero viscosity always
(C) static equilibrium
(D) irregular eddies and mixing

Correct Answer: D

Explanation: Turbulent flow is characterized by irregular eddies and mixing.

37. Reynolds number is used to judge whether flow is:

(A) laminar or turbulent
(B) solid or liquid
(C) hot or cold
(D) charged or neutral

Correct Answer: A

Explanation: Reynolds number is used to judge whether flow is laminar or turbulent.

38. Streamlines in steady flow:

(A) cross freely at many points
(B) do not cross
(C) exist only in solids
(D) must be straight

Correct Answer: B

Explanation: Streamlines in steady flow do not cross.

39. Equation of continuity for incompressible flow is:

(A) P + (1/2) rho v^2 = 0 always
(B) F = 6 pi eta r v
(C) A1 v1 = A2 v2
(D) v_t proportional to r

Correct Answer: C

Explanation: Volume flow rate is the same along the pipe.

40. Continuity for an incompressible fluid expresses conservation of:

(A) electric charge
(B) entropy only
(C) temperature
(D) mass (hence volume)

Correct Answer: D

Explanation: Mass in equals mass out; density constant so A v is constant.

41. If a pipe's cross-section is halved, incompressible speed:

(A) doubles
(B) halves

(C) stays the same
(D) becomes zero

Correct Answer: A

Explanation: A v = constant so half A means twice v.

42. A hose nozzle is narrowed to 1/4 of the hose area. Exit speed is:

(A) one quarter
(B) four times the hose speed
(C) unchanged
(D) sixteen times

Correct Answer: B

Explanation: A hose nozzle is narrowed to 1/4 of the hose area. Exit speed is four times the hose speed.

43. Volume flow rate Q equals:

(A) P / A
(B) eta v
(C) A v
(D) rho g h

Correct Answer: C

Explanation: Q is volume per time: area times speed.

44. Water in a pipe of radius 2 cm at 0.5 m/s enters a 1 cm radius pipe. Speed there is:

(A) 0.25 m/s
(B) 0.5 m/s
(C) 1 m/s
(D) 2 m/s

Correct Answer: D

Explanation: Area ratio is (2/1)^2 = 4, so v2 = 4 x 0.5 = 2 m/s.

45. Bernoulli's equation along a streamline is:

(A) P + (1/2) rho v^2 + rho g h = constant
(B) P = rho g h only, even when moving
(C) A v = F
(D) F = m a for a solid only

Correct Answer: A

Explanation: Mechanical energy per volume is conserved for ideal flow.

46. Bernoulli's equation is essentially:

(A) conservation of charge
(B) conservation of energy for flowing fluid
(C) Archimedes' principle only
(D) Stokes' law

Correct Answer: B

Explanation: Bernoulli's equation is essentially conservation of energy for flowing fluid.

47. In Bernoulli's equation, (1/2) rho v^2 is called:

(A) static pressure
(B) gauge vacuum
(C) dynamic pressure
(D) viscosity

Correct Answer: C

Explanation: It is the kinetic-energy density of the flow.

48. Where a horizontal pipe narrows, fluid speed rises and pressure:

(A) increases
(B) must equal vacuum

(C) becomes undefined
(D) decreases

Correct Answer: D

Explanation: Faster flow means smaller P so that P + (1/2) rho v^2 stays constant.

49. Bernoulli assumes the fluid is approximately:

(A) ideal, incompressible, steady, along a streamline
(B) always highly turbulent
(C) a rigid body
(D) superfluid only

Correct Answer: A

Explanation: Bernoulli assumes the fluid is approximately ideal, incompressible, steady, along a streamline.

50. Torricelli's theorem gives efflux speed from a tank as:

(A) 2 g h
(B) sqrt(2 g h)
(C) g h
(D) sqrt(g h)

Correct Answer: B

Explanation: It matches free-fall speed from height h of the free surface.

51. A hole 5 m below the free surface (g = 9.8) has efflux speed about:

(A) 5 m/s
(B) 2.2 m/s
(C) 10 m/s
(D) 98 m/s

Correct Answer: C

Explanation: sqrt(2 x 9.8 x 5) = sqrt(98) is about 9.9 m/s.

52. Torricelli speed is analogous to:

(A) terminal velocity in oil
(B) speed of light
(C) Stokes drag
(D) free-fall speed from height h

Correct Answer: D

Explanation: Torricelli speed is analogous to free-fall speed from height h.

53. A Venturi meter measures flow rate using:

(A) a constriction and the pressure drop
(B) temperature of the pipe
(C) upthrust on a ship
(D) viscosity of a solid

Correct Answer: A

Explanation: A Venturi meter measures flow rate using a constriction and the pressure drop.

54. In the throat of a Venturi, speed is higher so pressure is:

(A) higher
(B) lower
(C) exactly a perfect vacuum always
(D) infinite

Correct Answer: B

Explanation: In the throat of a Venturi, speed is higher so pressure is lower.

55. A perfume atomizer works because fast air over the tube:

(A) raises pressure and pushes liquid down
(B) sets viscosity to zero

(C) lowers pressure so liquid is pushed up by the atmosphere
(D) creates superfluid helium

Correct Answer: C

Explanation: A perfume atomizer works because fast air over the tube lowers pressure so liquid is pushed up by the atmosphere.

56. A filter (aspirator) pump creates suction by:

(A) Archimedes upthrust on air
(B) Magnus spin of the sink
(C) heating helium to 2.17 K
(D) a high-speed water jet that lowers pressure

Correct Answer: D

Explanation: A filter (aspirator) pump creates suction by a high-speed water jet that lowers pressure.

57. A carburetor draws fuel into the air stream because:

(A) the constriction lowers pressure at the jet
(B) high pressure pushes fuel away
(C) Stokes' law lifts drops only
(D) the car has terminal velocity

Correct Answer: A

Explanation: A carburetor draws fuel into the air stream because the constriction lowers pressure at the jet.

58. Lift on an aerofoil is mainly because air over the cambered top:

(A) moves slower so pressure above is higher
(B) moves faster so pressure above is lower
(C) has zero density
(D) is a superfluid

Correct Answer: B

Explanation: Lift on an aerofoil is mainly because air over the cambered top moves faster so pressure above is lower.

59. The Magnus effect is a sideways force on a:

(A) stationary cube in vacuum
(B) non-rotating raindrop only
(C) spinning ball or cylinder in a flow
(D) block of ice at rest

Correct Answer: C

Explanation: The Magnus effect is a sideways force on a spinning ball or cylinder in a flow.

60. A spinning football curves because:

(A) gravity acts sideways
(B) Archimedes fails in air
(C) continuity is violated
(D) one side has higher relative air speed and lower pressure

Correct Answer: D

Explanation: That pressure difference is the Magnus force.

61. Superfluidity is a state of essentially:

(A) zero viscosity (flow without dissipation)
(B) infinite viscosity
(C) maximum turbulence
(D) high density only

Correct Answer: A

Explanation: Superfluidity is a state of essentially zero viscosity (flow without dissipation).

62. Liquid helium-4 becomes superfluid below about:

(A) 273 K
(B) 2.17 K (lambda point)
(C) 100 K
(D) 0 degrees C

Correct Answer: B

Explanation: The He I to He II transition is near 2.17 K.

63. Superfluid helium can:

(A) never flow at all
(B) only freeze at 2.17 K and 1 atm easily
(C) creep as a film up walls and siphon out of a beaker
(D) have infinite eta

Correct Answer: C

Explanation: The Rollin film and creeping flow are classic He II effects.

64. Quantized vortices are a feature of:

(A) all laminar water taps
(B) Stokes spheres in honey
(C) ideal gases at STP only
(D) superfluids

Correct Answer: D

Explanation: Circulation in a superfluid is quantized in units of h/m.

65. The lambda point of helium-4 is where:

(A) it becomes superfluid (He I to He II)
(B) it boils at 1 atm (about 4.2 K)
(C) viscosity becomes infinite
(D) it is a solid at room pressure with no extra pressure

Correct Answer: A

Explanation: Boiling point at 1 atm is higher; lambda is the superfluid transition.

66. Density of water is about:

(A) 1 kg m^-3
(B) 1000 kg m^-3
(C) 9.8 kg m^-3
(D) 13600 kg m^-3

Correct Answer: B

Explanation: Density of water is about 1000 kg m^-3.

67. Gauge pressure in a static liquid at depth h is:

(A) (1/2) rho v^2
(B) 6 pi eta r
(C) rho g h
(D) always zero

Correct Answer: C

Explanation: Hydrostatic pressure increases linearly with depth.

68. Upthrust on volume V fully immersed in fluid of density rho is:

(A) rho_body V g
(B) eta V
(C) P A with P = 0
(D) rho V g

Correct Answer: D

Explanation: Weight of displaced fluid is rho V g.

69. High-speed quadratic drag is roughly:

(A) (1/2) C_d rho A v^2
(B) 6 pi eta r v in every case
(C) m g h
(D) A v with A the viscosity

Correct Answer: A

Explanation: High-speed quadratic drag is roughly (1/2) C_d rho A v^2.

70. Viscosity of liquids generally _____ as temperature rises:

(A) increases
(B) decreases
(C) stays exactly fixed
(D) becomes infinite

Correct Answer: B

Explanation: Molecules slide more easily when thermal motion is greater.

71. Viscosity of gases generally _____ as temperature rises:

(A) decreases
(B) drops to zero
(C) increases
(D) equals the liquid value

Correct Answer: C

Explanation: Momentum transfer between layers grows with molecular speed.

72. A streamline body is shaped to:

(A) increase turbulent wake drag
(B) maximize viscosity
(C) stop continuity
(D) reduce form drag by delaying separation

Correct Answer: D

Explanation: A streamline body is shaped to reduce form drag by delaying separation.

73. For incompressible flow, if A1 = 2 A2 then v2/v1 equals:

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

Correct Answer: A

Explanation: For incompressible flow, if A1 = 2 A2 then v2/v1 equals 2.

74. Two holes at the same depth in a tank have efflux speeds that are:

(A) proportional to hole area
(B) equal (same h)
(C) zero
(D) always sqrt(4 g h) and different

Correct Answer: B

Explanation: Two holes at the same depth in a tank have efflux speeds that are equal (same h).

75. Blood in a narrowed artery: speed _____ and pressure _____:

(A) decreases; increases
(B) both increase
(C) increases; decreases
(D) both decrease

Correct Answer: C

Explanation: Blood in a narrowed artery: speed _____ and pressure _____ increases; decreases.

76. A pitot tube is used to measure:

(A) viscosity of honey
(B) upthrust on a cube
(C) the lambda point
(D) flow speed from stagnation pressure

Correct Answer: D

Explanation: A pitot tube is used to measure flow speed from stagnation pressure.

77. Kinematic viscosity is defined as:

(A) eta / rho
(B) eta rho
(C) rho / eta
(D) eta + rho

Correct Answer: A

Explanation: It is dynamic viscosity divided by density.

78. Newton's law of viscosity says shear stress is proportional to:

(A) density only
(B) the velocity gradient
(C) pressure only
(D) temperature with no gradient

Correct Answer: B

Explanation: tau = eta (dv/dy) for a Newtonian fluid.

79. Simple Bernoulli is unreliable through a region with:

(A) a horizontal ideal-fluid pipe
(B) a Venturi of ideal fluid
(C) large viscous losses or an unaccounted pump
(D) steady streamline flow of an ideal fluid

Correct Answer: C

Explanation: Energy added or dissipated must be put in extra terms.

80. Critical velocity in a tube is the speed above which flow tends to become:

(A) static
(B) laminar always
(C) a superfluid
(D) turbulent

Correct Answer: D

Explanation: Critical velocity in a tube is the speed above which flow tends to become turbulent.

B. Less Important / Secondary Topics

81. A hydrometer is designed to measure:

(A) relative density of a liquid
(B) terminal velocity of rain
(C) Bernoulli constant
(D) the Magnus coefficient

Correct Answer: A

Explanation: A hydrometer is designed to measure relative density of a liquid.

82. Poise is a CGS unit of:

(A) pressure
(B) viscosity
(C) upthrust
(D) volume flow rate

Correct Answer: B

Explanation: Poise is a CGS unit of viscosity.

83. Reynolds number is of the form:

(A) eta / (rho v d)
(B) P + (1/2) rho v^2
(C) rho v d / eta
(D) 6 pi eta r

Correct Answer: C

Explanation: Reynolds number is of the form rho v d / eta.

84. Surface tension is not the same as viscosity: surface tension is:

(A) internal friction between layers
(B) weight of displaced fluid
(C) dynamic pressure
(D) energy per area / force per length of a surface

Correct Answer: D

Explanation: A needle can float by surface tension even if denser than water.

85. Mass continuity for a compressible fluid is:

(A) rho A v = constant
(B) A v = constant always
(C) P V = n R T only
(D) eta = 0

Correct Answer: A

Explanation: Mass flux, not volume flux, is conserved if density varies.

86. Specific gravity (relative density) is:

(A) weight in newtons
(B) density divided by density of water
(C) viscosity in poise
(D) pressure in pascals

Correct Answer: B

Explanation: Specific gravity (relative density) is density divided by density of water.

87. Creeping (Stokes) flow means:

(A) Re far above 10^6
(B) inviscid jet
(C) very low Reynolds number
(D) supersonic shock

Correct Answer: C

Explanation: Inertial terms are negligible compared with viscous terms.

88. The fountain effect is associated with:

(A) ordinary water in a Venturi
(B) Stokes raindrops
(C) carburetor icing only
(D) superfluid helium II

Correct Answer: D

Explanation: He II can be driven through a fine powder by a heat current.

89. Coefficient of viscosity of water at room temperature is about:

(A) 10^-3 Pa s
(B) 10^3 Pa s
(C) 1 Pa s
(D) 10 Pa s

Correct Answer: A

Explanation: Water is close to 0.001 Pa s (1 centipoise).

90. Air's viscosity is _____ that of water:

(A) much larger than
(B) much smaller than
(C) exactly equal to
(D) infinite compared with

Correct Answer: B

Explanation: Air's viscosity is _____ that of water much smaller than.

91. Angle of attack of an aerofoil is the angle between:

(A) span and gravity
(B) camber and viscosity
(C) chord and the oncoming flow
(D) weight and upthrust

Correct Answer: C

Explanation: Angle of attack of an aerofoil is the angle between chord and the oncoming flow.

92. A stagnation point is where flow speed is:

(A) a maximum
(B) equal to sqrt(2gh) always
(C) undefined
(D) zero (flow brought to rest)

Correct Answer: D

Explanation: Kinetic energy is converted to a pressure rise.

93. A Venturi manometer reading Delta h of liquid density rho_m relates to Delta P by:

(A) Delta P = rho_m g Delta h
(B) Delta P = 6 pi eta r
(C) Delta P = m g h of the ship
(D) Delta P = 0 always

Correct Answer: A

Explanation: A Venturi manometer reading Delta h of liquid density rho_m relates to Delta P by Delta P = rho_m g Delta h.

94. Aircraft often take off into the wind to:

(A) reduce airspeed over the wing
(B) increase airflow speed over the wings for a given ground speed
(C) cancel Magnus effect
(D) make viscosity infinite

Correct Answer: B

Explanation: Aircraft often take off into the wind to increase airflow speed over the wings for a given ground speed.

95. A cricket ball's reverse swing or curve in flight can involve:

(A) zero air density
(B) Archimedes on a vacuum
(C) asymmetric airflow and sometimes spin (Magnus)
(D) superfluid vortices in air at 300 K

Correct Answer: C

Explanation: Pressure differences from speed/spin/roughness deflect the path.

96. Pascal's principle (transmission of pressure) is distinct from Archimedes, which concerns:

(A) viscosity of honey
(B) Torricelli holes only
(C) the lambda point
(D) buoyant force from pressure variation with depth

Correct Answer: D

Explanation: Upthrust is the net of greater pressure on the lower surface.

97. Metacentre is used in discussing:

(A) stability of a floating ship
(B) Stokes' radius
(C) Venturi throat area
(D) He-4 vortices only

Correct Answer: A

Explanation: If metacentre is above CG, a small tilt produces a restoring moment.

98. Bluff bodies have large wakes and thus:

(A) small form drag
(B) large form drag
(C) zero drag in air
(D) only Stokes drag at all speeds

Correct Answer: B

Explanation: Bluff bodies have large wakes and thus large form drag.

99. Dynamic viscosity eta of a Newtonian fluid is independent of:

(A) temperature in every real fluid
(B) the identity of the fluid
(C) the shear rate (by definition of Newtonian)
(D) SI units

Correct Answer: C

Explanation: Non-Newtonian fluids have eta that depends on shear rate.

100. The two-fluid picture of He II includes:

(A) only ordinary water
(B) steel and air
(C) laminar and turbulent water at 20 C
(D) a superfluid component with eta = 0 plus a normal viscous component

Correct Answer: D

Explanation: The two-fluid picture of He II includes a superfluid component with eta = 0 plus a normal viscous component.

101. If both radius and viscosity double, Stokes terminal speed (no buoyancy) becomes:

(A) twice the original
(B) 4 times
(C) unchanged
(D) 1/4

Correct Answer: A

Explanation: v_t scales as r^2 / eta: factor 4 over factor 2 gives twice.

102. A small raindrop in still air reaches terminal speed when:

(A) weight is still much larger than drag
(B) weight is balanced by drag (and a small upthrust)
(C) drag is zero
(D) the drop has zero mass

Correct Answer: B

Explanation: Net force becomes zero so acceleration stops.

103. Volume flow 2 x 10^-4 m^2 times 0.5 m/s equals:

(A) 4 x 10^-4 m^3/s
(B) 0.5 m^3/s
(C) 1 x 10^-4 m^3/s

(D) 2 x 10^-4 m/s

Correct Answer: C

Explanation: Volume flow 2 x 10^-4 m^2 times 0.5 m/s equals 1 x 10^-4 m^3/s.

104. Warm syrup pours more easily mainly because:

(A) its density becomes zero
(B) g increases
(C) it becomes superfluid at 20 C
(D) its viscosity falls with temperature

Correct Answer: D

Explanation: Lower eta means less resistance to shear.

105. For a floating body, the fraction above water is:

(A) 1 - rho_body/rho_fluid
(B) rho_body/rho_fluid
(C) always 1/2
(D) g / 9.8

Correct Answer: A

Explanation: Immersed fraction is rho_body/rho_fluid; the rest is above.

106. A 10 cm cube of aluminium (not the water it displaces) has true weight much _____ 9.8 N:

(A) less than
(B) greater than
(C) equal to, always
(D) zero compared with

Correct Answer: B

Explanation: Aluminium is denser than water, so weight > upthrust of 9.8 N.

107. Along a horizontal streamline, Bernoulli reduces to:

(A) P + rho g h only with v ignored always
(B) A1 v1 = 0
(C) P + (1/2) rho v^2 = constant
(D) F = 6 pi eta r v

Correct Answer: C

Explanation: The rho g h term is the same if height does not change.

108. Helium must be cooled well below its 4.2 K boiling point to show:

(A) ordinary viscosity of water
(B) Venturi lift of an aerofoil
(C) Torricelli flow in air
(D) superfluid creeping and zero viscosity

Correct Answer: D

Explanation: Helium must be cooled well below its 4.2 K boiling point to show superfluid creeping and zero viscosity.