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Fluids and Pressure

Exam — Fluids & Pressure

Pre-med/IB-style questions on pressure, density, hydrostatics, Pascal's principle and hydraulics, buoyancy (Archimedes), atmospheric pressure devices, continuity and Bernoulli flow ideas, viscosity/laminar flow, and surface tension/capillarity. Emphasis on conceptual traps and real-world reasoning.

75 items — Printable Exam

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1 **Pressure is best defined as:**

- A Force multiplied by area
- B Force divided by area
- C Energy divided by time
- D Charge divided by time
- E Mass divided by volume

2 **A person stands on snow wearing boots. If they switch to skis (larger contact area) while their weight stays the same, the pressure on the snow:**

- A Increases
- B Decreases
- C Stays the same
- D Becomes zero
- E Depends only on snow temperature

3 **A student stands still on one foot instead of two (same weight). Compared with standing on two feet, the pressure on the ground is:**

- A About half
- B About double
- C Unchanged
- D Zero because there is no motion
- E Less because balance requires less force

4 **The SI unit of pressure (pascal, Pa) is equivalent to:**

A $N \cdot m$

B N/m

C N/m^2

D kg/m^2

E J/s

5 **In a fluid at rest, the pressure at a point acts:**

A Only downward

B Only upward

C Only sideways

D Equally in all directions

E Only along the direction of flow

6 **Two points are at the same depth in the same connected body of still water (same surface pressure). The pressure at these two points is:**

A Higher at the point directly under the surface center

B Higher at the point under the wider part of the container

C The same at both points

D Higher at the point closer to the wall

E Unpredictable without knowing container shape

7 **Which change would increase the pressure at a point 2 m below the surface of a lake (assuming the lake surface pressure stays atmospheric)?**

A Replacing water with a less dense liquid

B Decreasing the depth of the point

C Replacing water with a more dense liquid

D Making the lake wider

E Stirring the lake gently

8 **A container is filled with water to height h. Which statement about the pressure at the bottom is correct (water at rest, open to atmosphere)?**

A It depends on the container's shape

B It depends only on the base area

C It depends on water height h (and and g), not on shape

D It is always equal to atmospheric pressure

E It is zero at the bottom

9 **Two containers have the same water height h but different base areas. Which statement is correct about the FORCE from the water on the base (ignoring the container material)?**

A The force is the same because pressure is the same

B The container with larger base area has larger force because F = PA

C The force is larger in the narrow container because water is "more concentrated"

D Force depends only on the mass of water, not area

E The force must be zero if the water is at rest

10 **Gauge pressure is best described as:**

A Pressure measured relative to vacuum

B Pressure measured relative to atmospheric pressure

C Pressure measured only in liquids

D Pressure that cannot be negative

E Pressure multiplied by volume

11 **A tire pressure gauge reads 2.0 bar. This measurement is most likely:**

A Absolute pressure inside the tire

B Gauge pressure above atmospheric pressure

C The pressure at the center of the tire only

D The pressure difference between two sides of the tire

E The pressure outside the tire

12 **In a U-tube manometer containing the same liquid in both arms, a height difference Δh between the columns indicates that the pressure difference between the two connected points is proportional to:**

A Δh only

B only

C $g\Delta h$

D $g/\Delta h$

E Δh^2

13 **If you use a denser manometer liquid (e.g., mercury instead of water) to measure the same pressure difference, the height difference Δh will be:**

A Larger

B Smaller

C The same

D Zero

E Negative

14 **A mercury barometer works because:**

A Mercury is magnetic and is pulled upward

B Atmospheric pressure pushes on the mercury reservoir and supports a column of mercury

C A pump inside the tube pulls mercury up continuously

D The vacuum above mercury pulls it upward

E Mercury creates its own pressure upward

15 **Why can you drink through a straw (ignoring viscosity limits)?**

A Because you pull the liquid upward with your mouth like a vacuum cleaner

B Because you reduce pressure inside the straw and atmospheric pressure pushes the liquid up

C Because gravity pulls the liquid up the straw

D Because liquids naturally rise in narrow tubes no matter what

E Because your mouth adds mass to the liquid

16 **A diver goes deeper in the ocean. The main reason the pressure increases is:**

A The diver's mass increases with depth

B Water becomes less dense with depth so pressure rises

C There is more water above, so the weight of the water column increases pressure

D Atmospheric pressure increases underwater

E Pressure increases because the diver moves faster

17 **Two points are at the same depth: one in oil and one in water. Both liquids are open to the same atmospheric pressure. If oil is less dense than water, the pressure at the point in oil is:**

A Greater because oil is thicker

B The same because depth is the same

C Smaller because is smaller in $P = P0 + gh$

D Zero because oil floats

E Unpredictable without container shapes

18 **Pascal's principle states that:**

A Pressure in a moving fluid decreases as speed increases

B A pressure change applied to an enclosed fluid is transmitted undiminished throughout the fluid

C Buoyant force equals the weight of displaced fluid

D Fluid flows from low pressure to high pressure

E Pressure depends on container shape

19 **A hydraulic lift has a small piston area A1 and a large piston area A2, with A2 $>$ A1. If a force F1 is applied to the small piston, the output force F2 on the large piston (ideal system) is:**

A $F2 = F1$

B $F2 = F1(A1/A2)$

C $F2 = F1(A2/A1)$

D $F2 = F1 + (A2 - A1)$

E $F2 = F1(A1 + A2)$

20 **In the same hydraulic lift (ideal), if the large piston produces 10 times the force of the small piston, then the large piston must move:**

A 10 times farther than the small piston

B The same distance as the small piston

C 1/10 the distance of the small piston

D 100 times farther than the small piston

E In the opposite direction

21 **In an ideal hydraulic system (no losses), which statement about work is correct?**

A Output work is greater because force is amplified

B Input work is greater because small piston is smaller

C Input work equals output work (ignoring losses)

D No work is done because the fluid is at rest

E Work depends only on pressure, so it cancels to zero

22 **Buoyant force (upthrust) on an object fully or partially submerged in a fluid equals:**

A The object's weight

B The weight of the displaced fluid

C The mass of the displaced fluid

D The pressure at the top surface only

E The fluid's weight

23 **An object floats at rest in water. Which statement must be true?**

A The object's weight equals the buoyant force

B The buoyant force is greater than the object's weight

C The object's density is greater than water

D The object displaces its own volume of water

E The pressure at the bottom of the object is zero

24 **An object is fully submerged and suspended in a fluid without touching the bottom. If the fluid is incompressible and the object's volume does not change, the buoyant force depends on:**

A Only the object's mass

B Only the object's depth below the surface

C The fluid density and the object's volume

D Only the container's shape

E Only the atmospheric pressure

25 **A steel ship floats in water because:**

A Steel is less dense than water

B The ship's average density (including air inside) is less than water

C Water exerts no pressure on steel

D Gravity is weaker on ships

E The ship pushes water downward which cancels its weight

26 **A block sinks in fresh water but floats in salt water. The best explanation is:**

A Salt water has smaller density so buoyant force is smaller

B Salt water has larger density so buoyant force for the same displaced volume is larger

C Salt water has lower pressure so objects float

D Fresh water exerts buoyancy only on metals

E Buoyancy depends only on the object's weight

27 **A sealed balloon filled with helium rises in air mainly because:**

A Helium has negative weight

B Air pressure is zero at ground level

C The buoyant force from displaced air exceeds the balloon's weight

D Helium pushes downward on the Earth

E The balloon is pulled upward by the vacuum of space

28 **A rock is weighed in air and then weighed while fully submerged in water using a spring balance. The reading in water is smaller because:**

A The rock loses mass in water

B Gravity is weaker in water

C Buoyant force acts upward, reducing the tension in the spring

D Water pushes downward on the rock

E Water removes the rock's weight completely

29 **A rigid object is fully submerged in a large tank of water and held stationary. If you move it deeper while keeping it fully submerged, the buoyant force (assuming water incompressible) will:**

- A Increase because pressure is higher deeper down
- B Decrease because pressure squeezes the object
- C Stay the same because displaced volume stays the same
- D Become zero at great depth
- E Reverse direction

30 **A compressible balloon is fully submerged in water. As it is taken deeper, its volume decreases. The buoyant force on it will tend to:**

- A Increase because pressure increases
- B Decrease because displaced volume decreases
- C Stay constant because buoyancy depends only on depth
- D Become negative (downward buoyancy)
- E Become independent of fluid density

31 **A floating iceberg melts completely in the ocean. Ignoring temperature and salinity changes, the sea level will:**

- A Rise
- B Fall
- C Stay the same
- D Oscillate up and down
- E Become zero

32 **A wooden block floats in water. If the block is cut exactly in half (two smaller blocks), then each half will float:**

A More deeply because it is smaller

B Less deeply because it is lighter

C With the same fraction submerged as before

D Only if the cut surface is vertical

E Not at all because the block is no longer sealed

33 **A block has density 0.80 times the density of water. When floating at rest, the fraction of its volume submerged is closest to:**

A 0.20

B 0.50

C 0.80

D 1.00

E 1.25

34 **Continuity equation for steady flow of an incompressible fluid in a pipe states that:**

A Pressure is constant everywhere

B Speed is constant everywhere

C Volume flow rate Av is constant along the pipe

D Density increases in narrower sections

E Flow rate depends only on height

35 **Water flows steadily through a horizontal pipe that narrows from a wide section to a narrow section. Compared to the wide section, in the narrow section the water speed is:**

A Smaller

B The same

C Greater

D Zero

E Negative

36 **For steady incompressible flow in a horizontal pipe (ignoring viscosity), if speed increases in a narrower section, the pressure there is typically:**

A Higher

B Lower

C The same

D Zero

E Undefined because pressure only exists in static fluids

37 **A garden hose has a nozzle that makes the outlet area smaller. Why does water exit faster from the nozzle?**

A Because pressure always increases in narrower pipes

B Because the same flow rate must pass through a smaller area, increasing speed (continuity)

C Because water becomes more dense in the nozzle

D Because gravity pulls harder at the nozzle

E Because Bernoulli says speed decreases when area decreases

38 **Water comes out of two small holes in the side of a tank: one hole is near the surface, the other is much deeper. Ignoring viscosity and air resistance, the jet from the deeper hole exits:**

A Slower because water has more weight above it

B At the same speed because both are in the same tank

C Faster because the pressure difference driving the flow is larger at greater depth

D Only if the tank is wide

E Slower because pressure is used up pushing sideways

39 **Two holes at the same depth in a tank: one hole is twice the diameter of the other. Ignoring viscosity, which is correct about the exit speed of water?**

A The larger hole produces a faster jet

B The smaller hole produces a faster jet

C Both jets have the same exit speed

D The exit speed depends on hole area via $v = Agh$

E No jet forms from the smaller hole

40 **A Venturi meter measures flow speed by using the fact that in a narrowing pipe the fluid speed increases and the pressure:**

A Increases

B Decreases

C Stays constant

D Becomes equal to atmospheric pressure

E Becomes negative by definition

41 **Why is a shower curtain often pulled inward toward the water stream during a hot shower?**

A Because water molecules attract the curtain electrically

B Because fast-moving air/water flow near the curtain lowers pressure there, so higher outside air pressure pushes the curtain inward

C Because the curtain becomes heavier when wet

D Because gravity reverses inside the shower

E Because pressure is always higher where speed is higher

42 **Two strips of paper hang side-by-side with a small gap between them. If you blow air through the gap, the strips tend to move:**

A Apart, because air pushes them outward

B Together, because faster air between them lowers pressure there

C Nowhere, because air has no pressure when moving

D Randomly, because Bernoulli is unpredictable

E Upward, because air is lighter than paper

43 **An airplane wing generates lift partly because air moves faster over the top surface, making the pressure above the wing:**

A Higher than below, pushing the wing down

B Lower than below, contributing to an upward net force

C Exactly equal to below, so lift is impossible

D Zero because air is a gas

E Independent of speed because pressure is constant in fluids

44 **In a horizontal pipe narrowing gradually, water speeds up. For the water to speed up, there must be:**

A No net force on the fluid element, because fluids speed up naturally

B A net force in the direction of flow, which can be provided by a pressure difference

C A net upward force only

D Zero pressure everywhere

E Only gravity providing acceleration

45 **A pitot tube is used to measure fluid speed by comparing:**

A Temperature and density

B Static pressure and stagnation (total) pressure

C Volume and mass

D Viscosity and surface tension

E Electric potential and current

46 **Viscosity is best described as a fluid's:**

A Tendency to expand when heated

B Resistance to flow (internal friction)

C Ability to store pressure

D Density

E Tendency to float

47 **Flow in a narrow tube is laminar (smooth) at low speeds but can become turbulent at high speeds. Which change is most likely to promote turbulence?**

A Decreasing flow speed

B Increasing viscosity

C Increasing flow speed

D Making the tube perfectly smooth

E Using a denser fluid always prevents turbulence

48 **For laminar flow in a cylindrical tube (Poiseuille's idea), the volume flow rate is extremely sensitive to the tube radius. If the tube radius is doubled (same pressure difference), the flow rate changes by a factor of:**

A 2

B 4

C 8

D 16

E 1/2

49 **A blood vessel slightly narrows (vasoconstriction). If everything else stayed the same and flow remained laminar, the resistance to flow would:**

A Decrease slightly

B Increase strongly

C Stay the same because pressure adjusts

D Become zero

E Change only if density changes

50 **Surface tension is mainly due to:**

A Gravity pulling surface molecules upward

B Attractive forces between molecules at the surface creating a "skin-like" effect

C Air pressure pushing down

D The density of the liquid being large

E Electric current in the liquid

51 **Detergents help wash dishes partly because they:**

A Increase surface tension so water beads up

B Decrease surface tension so water spreads and wets surfaces better

C Increase density of water

D Increase hydrostatic pressure

E Stop capillary action completely

52 **Capillary rise is generally higher in a thinner tube than in a thicker tube because:**

A Pressure is higher in thinner tubes by definition

B Surface tension effects become more significant relative to the weight of the liquid column in thinner tubes

C Gravity is weaker in thinner tubes

D Thinner tubes create more atmospheric pressure

E Liquids always rise to the same height regardless of tube radius

53 **A soap bubble tends to be spherical because a sphere:**

A Has the largest surface area for a given volume

B Has the smallest surface area for a given volume, minimizing surface energy

C Has zero pressure inside

D Is pushed into shape by gravity alone

E Requires no surface tension

54 **A dam wall must be thicker near the bottom mainly because:**

A The water is colder at the bottom

B Pressure increases with depth, so the force per area on the wall is greater at the bottom

C Water density is zero at the surface

D Water flows faster at the bottom

E Atmospheric pressure is larger at the bottom of a lake

55 **A student says: "The pressure at the bottom of a lake depends on the total volume of water in the lake." The best response is:**

A Correct, because more water means more pressure

B Incorrect: bottom pressure depends mainly on depth (and and g), not total volume

C Correct only if the lake is circular

D Correct only if the lake is shallow

E Incorrect because pressure is always the same everywhere in water

56 **Which principle primarily explains why a hydraulic car jack can lift a car with a relatively small input force?**

A Bernoulli's principle

B Archimedes' principle

C Pascal's principle

D Newton's law of gravitation

E Snell's law

57 **Which principle primarily explains why pressure can drop in a region where a fluid moves faster along a streamline (same height, negligible viscosity)?**

A Pascal's principle

B Bernoulli's principle

C Archimedes' principle

D Hooke's law

E Ohm's law

58 **Which statement about negative gauge pressure is correct?**

A It means absolute pressure is negative

B It means the pressure is below atmospheric pressure

C It means there is no pressure at all

D It can never happen because pressure cannot be less than atmospheric

E It means density is negative

59 **A suction cup sticks to a wall mainly because:**

A It creates a region of lower pressure inside, so outside atmospheric pressure pushes it against the wall

B It uses magnetism

C It creates a region of higher pressure inside, pulling it to the wall

D Gravity presses it onto the wall

E It works even in perfect vacuum equally well

60 **Water boils at a lower temperature on a high mountain mainly because:**

A Water's density decreases with altitude

B Atmospheric pressure is lower, so boiling occurs when vapor pressure reaches a lower external pressure

C Gravity is much stronger at altitude

D Water becomes a different chemical at altitude

E Surface tension becomes zero

61 **In a closed syringe filled with water (no air), if you push the plunger slightly inward, the pressure in the water:**

A Increases only near the plunger

B Increases everywhere throughout the water almost equally

C Decreases everywhere

D Stays the same because water is incompressible

E Becomes zero

62 **A large stone is lowered slowly into a bucket full of water. Water spills over the edge. The spilled water volume equals:**

A The stone's mass

B The stone's weight

C The volume of water displaced (approximately the submerged volume of the stone)

D The bucket's volume

E Zero because water is incompressible

63 A floating object is pushed down so it is fully submerged and then released. What happens immediately after release (assuming it's less dense than the fluid)?

A It stays where it is because buoyancy is the same as weight

B It accelerates upward because buoyant force exceeds its weight when fully submerged

C It accelerates downward because pressure is higher below

D It becomes neutrally buoyant automatically

E It sinks because the fluid has entered it

64 An object is neutrally buoyant in water. This means:

A It experiences no forces at all

B Its density equals the density of water, so buoyant force equals its weight when fully submerged

C Its mass is zero

D It must float partially above the surface

E Pressure is the same above and below it

65 **A stone is dropped into a river and sinks. Which statement about the buoyant force is correct?**

A Buoyant force is zero because it sinks

B Buoyant force acts upward but is smaller than the stone's weight

C Buoyant force acts downward when objects sink

D Buoyant force equals the stone's weight, but the stone sinks anyway

E Buoyant force depends only on the stone's weight

66 **A hydrometer is used to measure fluid density by floating at different depths. It floats higher in a denser liquid because:**

A Denser liquids have less buoyant force

B Denser liquids provide more buoyant force per displaced volume, so less volume needs to be submerged to balance weight

C Pressure is lower in denser liquids

D The hydrometer becomes lighter in dense liquids

E Denser liquids always push objects downward

67 **A U-tube contains water in one arm and oil in the other, and the two liquids do not mix. If the oil is less dense than water, then at the same horizontal level where both sides contain liquid, the pressure:**

A Is higher on the oil side

B Is higher on the water side

C Must be equal on both sides (hydrostatic equilibrium)

D Is zero on both sides

E Depends on which side has more volume

68 **In a static fluid, why does pressure increase with depth?**

A Because deeper fluid molecules move faster

B Because the weight of fluid above must be supported by pressure differences

C Because atmospheric pressure increases underwater

D Because gravity decreases with depth so pressure must compensate

E Because deeper parts have less volume

69 **A container of water is in free fall (e.g., dropped). Neglecting air resistance, inside the freely falling container the effective buoyant force on a small submerged object tends to:**

A Increase dramatically

B Stay exactly the same as normal

C Decrease toward zero, because the pressure gradient associated with gravity is effectively removed in the falling frame

D Reverse direction and push downward

E Become infinite

70 **A siphon can move water from a higher container to a lower container over a hump because:**

A Water is pulled over the hump by suction alone

B Gravity acting on the descending side creates lower pressure at the top and atmospheric pressure helps push liquid up the rising side, as long as the outlet is lower than the source surface

C Water flows from low pressure to high pressure naturally

D Siphons work only in vacuum

E A siphon violates energy conservation

71 **Cavitation in a fast-moving propeller occurs when:**

A Pressure becomes high enough to freeze water

B Local pressure drops low enough that water can vaporize, forming bubbles

C Density becomes negative

D Water speed becomes zero everywhere

E Buoyancy reverses direction

72 **At a high mountain, the mercury barometer height is smaller than at sea level mainly because:**

A Mercury density decreases at altitude

B Atmospheric pressure is lower, so it supports a shorter mercury column

C Gravity becomes zero

D Vacuum pressure increases

E Mercury evaporates faster

73 **In a static fluid, pressure forces on a solid surface act:**

A Parallel to the surface (tangential)

B Perpendicular (normal) to the surface

C Always upward

D Always toward the center of the container

E Only along the direction of gravity

74 **A cube of side length L is fully submerged in water. The pressure at the bottom face is greater than at the top face. The buoyant force is the net result of:**

A Equal pressures cancelling in all directions

B Greater upward pressure force on the bottom than the downward pressure force on the top

C Gravity pushing the cube upward

D Water friction pulling the cube upward

E Atmospheric pressure acting only on the bottom face

75 **A floating ship enters a lock where the water level is raised while the ship remains floating freely. As the water level rises, the buoyant force on the ship:**

A Increases because pressure is higher

B Decreases because pressure is higher

C Stays equal to the ship's weight (so it remains essentially unchanged)

D Becomes zero because the ship is now higher

E Depends only on the lock's width

#	Ans	Answer Text
	B	
2	B	Decreases
	B	
4	C	N/m^2
	D	
6	C	The same at both points
	C	
8	C	It depends on water height h (and and g), not on shape
	B	
10	B	Pressure measured relative to atmospheric pressure
	B	
12	C	$g\Delta h$
	B	
14	B	Atmospheric pressure pushes on the mercury reservoir and supports a colu...
	B	
16	C	There is more water above, so the weight of the water column increases p...
	C	
18	B	A pressure change applied to an enclosed fluid is transmitted undiminish...
	C	
20	C	1/10 the distance of the small piston
	C	
22	B	The weight of the displaced fluid
	A	
24	C	The fluid density and the object's volume
	B	
26	B	Salt water has larger density so buoyant force for the same displaced vo...
	C	
28	C	Buoyant force acts upward, reducing the tension in the spring
	C	
30	B	Decrease because displaced volume decreases
	C	
32	C	With the same fraction submerged as before
	C	
34	C	Volume flow rate Av is constant along the pipe
	C	
36	B	Lower
	B	
38		Faster because the pressure difference driving the flow is larger at gre...