

CPS lesson
Fluids
ANSWER KEY

1.

Imagine holding two bricks underwater. Brick A is just beneath the surface of the water, while B is at a greater depth. Which brick requires a greater force to hold it in place?

A. A

B. B

* C. both the same

2. When a hole is made in the side of a container of water, water flows out and follows a parabolic trajectory. If the container is now dropped in freefall, the water flow:

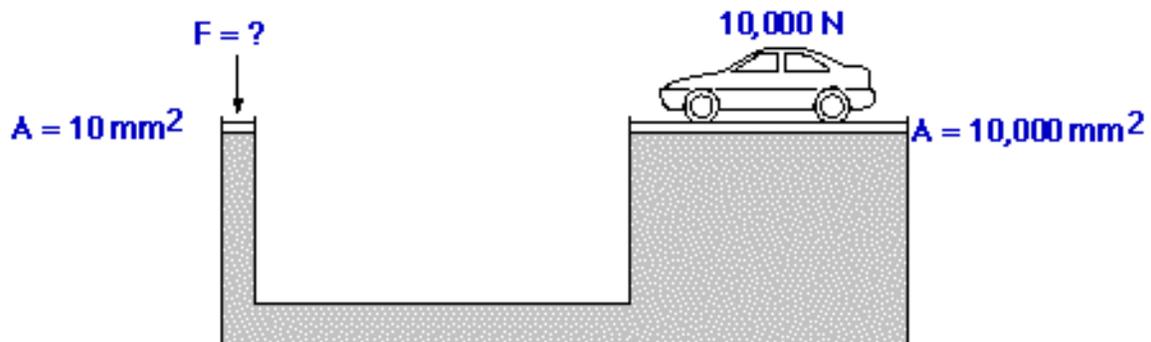
A. continues to follow a parabolic trajectory

B. comes out in a straight line

C. curves upward

* D. stops altogether

3. What force must be exerted on the left piston to balance the car?



- * A. 10 N
- B. 100 N
- C. 1000 N
- D. 10,000 N
- E. 100,000 N

4.
A 200-ton ship enters a canal lock which has the same shape as the ship's hull. Can the ship float in 1 ton of water?

- * A.
Yes
- B.
No

5.
Two cups are filled to the same level of water, but one has ice cubes floating at its surface.

Which cup weighs more?

- A. The cup with the ice.
- B. The cup without the ice.
- * C. Both weigh the same.

6.
Two cups are filled to the same level of water, but one has ice cubes floating at its surface.

After the ice melts, in which cup will the water level be higher?

- A. The cup with the ice.
- B. The cup without the ice.
- * C. Both the same.

7.

Two cups are filled to the same level of water, but one has plastic beads floating at its surface.

Which cup weighs more?

- A. The cup with the beads.
- B. The cup without the beads.
- * C. Both weigh the same.

8.

A lead weight is fastened to the top of a piece of styrofoam floating in water. Due to the weight of the lead, the water level is flush with the top surface of the foam. If the piece of styrofoam is now turned upside-down and refloated:

- * A. the water level will be below the top surface of the foam
- B. the water level will remain flush with the top surface of the foam
- C. the water level will be above the top surface of the foam

9.

A lead weight is fastened to the top of a piece of styrofoam floating in water. Due to the weight of the lead, the water level is flush with the top surface of the foam. If the piece of styrofoam is now turned upside-down and refloated:

- A. the water level in the container rises
- * B. it stays the same
- C. the level drops

10.

A boat carrying a large boulder floats in a swimming pool. The boulder is thrown overboard and sinks to the bottom. The overall water level in the pool:

- A. rises
- B. remains the same
- * C. drops

11. A plastic ball floats in water but sinks in oil. The oil floats on water.

The ball is in a cylinder half-full of water. Oil is slowly poured on top and covers the ball. The ball will:

- * A. move up in the cylinder
- B. remain in place
- C. move downward

12.

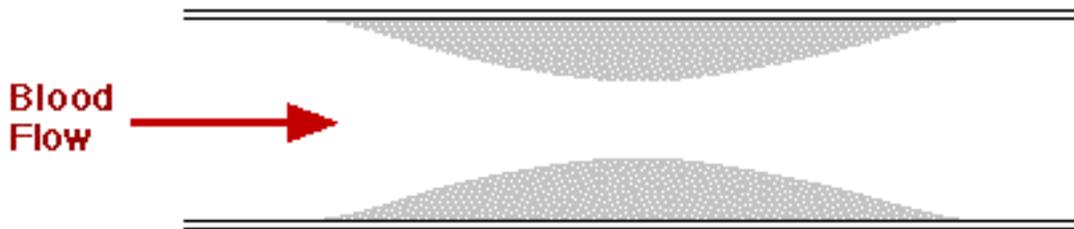
An object is floating in a beaker of water. You place the beaker in an elevator accelerating upward. What happens?

- A. more of the object will be underwater
- B. less of the object will be below the water level
- * C. there will be no change

13. A circular hoop is held in a stream of water, perpendicular to the current. If the area of the hoop is doubled, the flux of water through it:

- A. is quartered
- B. is halved
- C. remains the same
- * D. is doubled
- E. is quadrupled

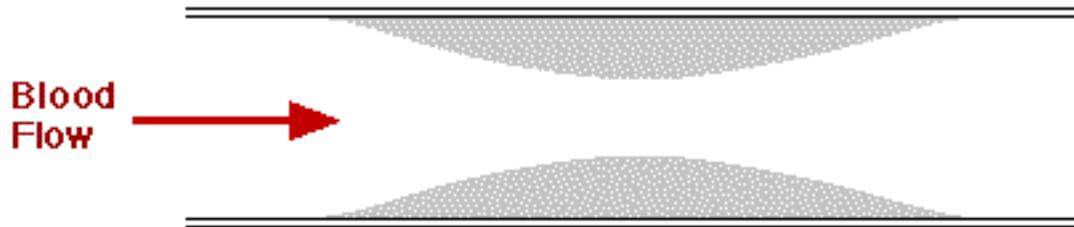
14. Blood flows through an artery that is partly blocked. Through which part of the artery is the flux largest?



- A.
the narrow part
- B.
the wide part
- * C.
both the same

15.

Blood flows through an artery that is partly blocked. Through which part of the artery is the speed largest?

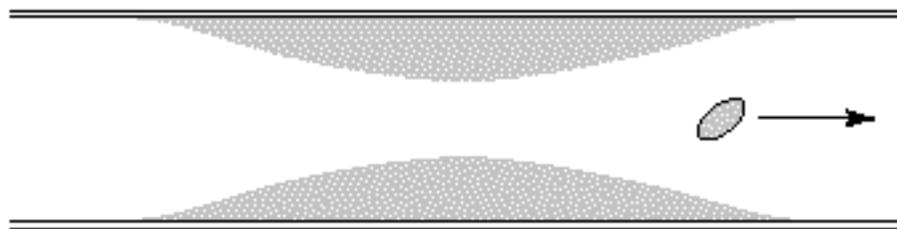


- * A. the narrow part
- B. the wide part
- C. both the same

16. Two hoses, one of 2-cm diameter and the other of 3-cm diameter, are connected one after the other to a faucet. In which hose is the flow speed larger?

- * A. the 2-cm hose
- B. the 3-cm hose
- C. same for both
- D. it depends on which hose is closer to the faucet

17. A blood platelet drifts along with the flow through an artery that is partly blocked. As the platelet moves from the narrow back to the wide region, its speed:



A.

increases

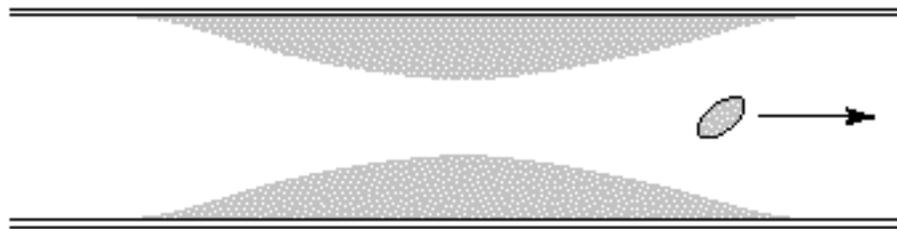
B.

remains the same

* C.

decreases

18. A blood platelet drifts along with the flow through an artery that is partly blocked. As the platelet moves from the narrow back to the wide region, it experiences:



A.

a pressure drop

* B.

a pressure rise

C.

no change in pressure

19.

Pascal's law states:

A. The buoyant force equals the weight of fluid displaced.

B. Pressure increases linearly with depth.

* C. External pressure is transmitted equally throughout a fluid.

D. The pressure is inversely proportional to the speed of a fluid along a streamline.

20.

The absolute pressure at the bottom of the Chesapeake Bay results from:

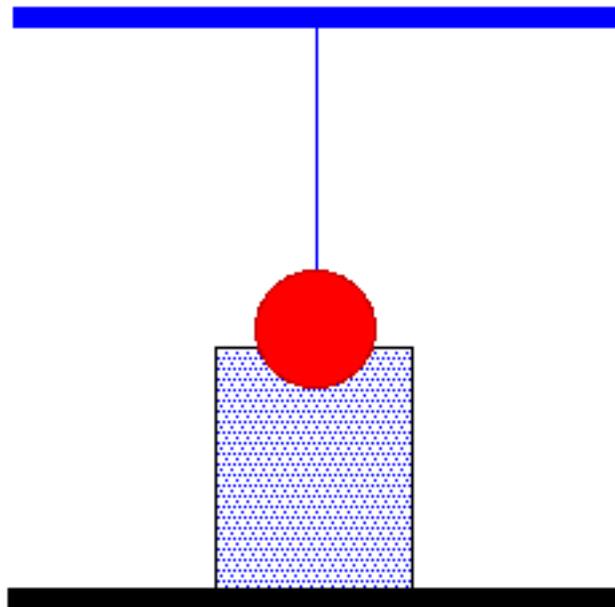
- A. the weight of the water above it only
- B. the weight of the earth beside it only
- * C. the weight of the water and air above it only
- D. the weight of the water and air above it and of the earth beside it

21. T = tension in string

B = buoyant force

N = normal force

The free-body diagram of the ball of mass m partly submerged in a fluid of mass M must include:



A.

mg, Mg

* B.
mg, B, T

C.
mg, T

D.
mg, T, B, N

22. The damping time for a cylinder in a viscous fluid is proportional to its radius squared. A 1-cm model has a 10-s time constant. The damping time of a 10-m Trident sub will therefore be:

A. 10 s

B. 1000 s

C. 100,000 s

* D. 10,000,000 s

23.
An ideal fluid has zero viscosity and constant density.

* A.
True

B.
False

24.
Which of the following statements is false?

A. Lift is the vertical component of the force exerted by the air on a wing.

B. Lift depends on the speed of the airplane.

* C. Blood travels slower than normal in a constricted artery.

D. Above some critical speed, fluid flow becomes turbulent.

25.

Which of the following statements is false?

A. In steady flow the velocity of the fluid is time independent at each point in space.

B. In irrotational flow a small paddlewheel placed in the fluid would not spin.

C. In laminar flow the streamlines never cross.

* D. All of the above statements are true.

26.

Which of the following statements is true?

* A. Pressure is a scalar.

B. Pressure increases when you increase the area over which a given force is applied.

C. A tire gauge measures absolute pressure.

D. All of these statements are false.

27.

Two objects A and B have equal volume and are at the same depth underwater. Object A is a sphere, while object B is a thin pancake with large cross-sectional area. On which object is the buoyant force larger?

A. A

B. B

* C. both the same

28.

The buoyant force is equal to the weight of fluid occupying the same volume as the submerged portion of the object.

* A.

True

B.

False

29. A water droplet sprayed horizontally out of an atomizer has a kinetic energy which decreases exponentially with the distance traveled divided by the radius of the droplet. What is the ratio of the distance traveled by a droplet of mass $2m$ to that of a droplet with mass m , if you impart the same initial kinetic energy to both?

* A. $2^{1/3}$

B. 2

C. 2^3

30. Which statement is false about the steady flow of an incompressible fluid?

A. The flow velocity is tangent to the streamline.

B. Streamlines cannot cross each other.

C. The greater the spacing between streamlines, the lower the flow speed.

* D. All of the above statements are true.

31. When the speed of fluid flow along a streamline increases, the pressure of the fluid decreases. This is a statement of:

- A. Pascal's principle
- B. the equation of continuity
- * C. Bernoulli's equation
- D. none of the above

32. A label on a football reads, "Inflate to 13 pounds." When properly inflated, which of the following quantities will be 13 pounds?

- A. the weight of the air in the football
- B. the total force on the inner surface of the football due to air pressure
- C. the gravitational force on the football and the air inside it
- * D. the net force of the air pressing on each square inch of the football's surface

33. A car is on the output side of an ideal hydraulic jack. The input piston has a smaller area than the output piston. Compared to trying to lift the car without the jack:

- A. it requires less force and less energy to do so
- B. it requires the same force but less energy
- * C. it requires less force but the same energy
- D. it requires less force but more energy