St John Baptist De La Salle Catholic School, Addis Ababa

Grade 12 Physics Midterm Examination

1st Quarter

October, 2024

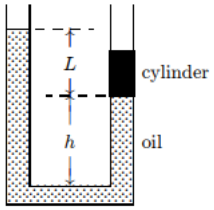
Name:_____ Section: ____ Time Allowed: **1 hour**

Part I: Multiple Choice Questions

1. (1 point) Mercury is a convenient liquid to use in a barometer because:
   A. it is a metal B. it has a high boiling point C. it expands little with temperature
   D. it has a high density E. it looks silvery

2. A closed hemispherical shell of radius R is filled with fluid at uniform pressure p. The net force of the fluid on the curved portion of the shell is given by:
   A. $2\pi R^2 p$ B. $\pi R^2 p$ C. $\frac{2}{3}\pi R^2 p$ D. $\pi R^2 p$ E. $\frac{2\pi}{R^2 p}$

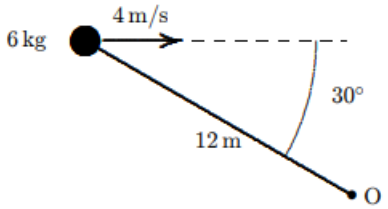
3. The diagram shows a U-tube with cross-sectional area A and partially filled with oil of density ρ. A solid cylinder, which fits the tube tightly but can slide without friction, is placed in the right arm. The system is in equilibrium. What is the weight of the cylinder?



   A. $AL\rho g$ B. $L^3\rho g$ C. $A\rho(L+h)g$ D. $A\rho(L-h)g$ E. None of the above.

4. A child exerts a tangential 40.0-N force on the rim of a disk-shaped merry-go-round with a radius of 2.40 m. If the merry-go-round starts at rest and acquires an angular speed of 0.0870 rev/s in 3.50 s, what is its mass?
   A. 343 kg B. 288 kg C. 102 kg D. 42.2 kg E. None of the above.

5. A 6.0-kg particle moves to the right at 4.0 m/s as shown. The magnitude of its angular momentum about the point O in $kg \cdot m^2/s$ is:



   A. 0 B. 288 C. 144 D. 24 E. 249

6. In a stationary homogeneous liquid:

A. pressure is the same at all points

B. pressure depends on the direction

C. pressure is independent of any atmospheric pressure on the upper surface of the liquid

D. pressure is the same at all points at the same level

E. none of the above

7. A certain object floats in fluids of density

(I) 0.9 ρ_o

(II) ρ_o

(III) 1.1 ρ_o

Which of the following statements is true?

A. . the buoyant force of fluid (I) is greater than the buoyant forces of the other two fluids

B. the buoyant force of fluid (III) is greater than the buoyant forces of the other two fluids

C. the three fluids exert the same buoyant force

D. the object displace the same volume of all three fluids

E. none of these are true

8. An object hangs from a spring balance. The balance indicates 30 N in air and 20 N when the object is submerged in water. What does the balance indicate when the object is submersed in a liquid with a density that is half that of water?
A. 20 N B. 25 N C. 30 N D. 35 N E. 40 N

9. A loaded ship passes from a lake (fresh water) to the ocean (saltwater). Saltwater is more dense than fresh water and as a result the ship will:
A. ride higher in the water B. settle lower in the water C. ride at the same level in the water
D. experience an increase in buoyant force E. experience a decrease in buoyant force

10. A hydraulic press has one piston of diameter 2.0 cm and the other piston of diameter 8.0 cm. What force must be applied to the smaller piston to obtain a force of 1600 N at the larger piston?
A. 6.25 N B. 25 N C. 100 N D. 400 N E. 1600 N

11. A 210-g object apparently loses 30 g when suspended in a liquid of density 2.0 g/cm^3. The density of the object is:
A. 7.0 g/cm3 B. 3.5 g/cm3 C. 1.4 g/cm3 D. 14 g/cm3 E. none of these

12. A rectangular boat made out of concrete with a mass of 3000 kg floats on a freshwater lake (ρ=1000 kg/m^3). If the bottom area of the boat is $6m^2$, how much of the boat is submerged?
A. 0.7 m B. 0.5 m C. 1.5 m D. 3.5 , E. None of the above.

13. A diver's pressure gauge reads 250,000 Pascals in fresh water (ρ=1000 kg/m^3). How deep is the diver?
A. 12.5 m B. 25.5 m C. 20.5 m D. 50.25 m E. None of the above.

14. A steel cable holds a 120-kg shark tank 3 meters below the surface of saltwater. If the volume of water displaced by the shark tank is $0.1m^3$, what is the tension in the cable? Assume the density of saltwater is $1025kg/m^3$.
A. 192 N B. 172 N C. 822 N D. 12 N E. None of the above.

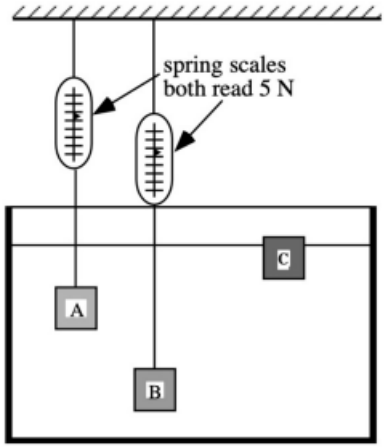
15. Earth has an orbital period of 365 days and its mean distance from the Sun is $1.495x10^8$ km. The planet Pluto's mean distance from the Sun is $5.896x10^9$km. What is Pluto's orbital period in Earth days?
A. 1.6×10^5 days B. 1.6×10^4 days C. 9.0×10^5 days D. 9.0×10^4 days E. None of the above.

Part II: Free Response Questions

16. A simple model considers a continent as a block (density$\approxeq 2800 kg/m^3$) floating in the mantle rock around it (density$\approxeq 3300 kg/m^3$). Assuming the continent is 35 km thick (the average thickness of the Earth continental crust), estimate the height of the continent above the surrounding rock.

17. A glass stopper has a mass of 4.50 g when measured in air, 2.50 g in water, and 0.50 g in a certain acid. What is the density of the acid? Its specific gravity?

18. Three blocks of the same size and shape are placed in a tank of water. The masses of the blocks are unknown. Blocks A and B are suspended from strings attached to spring scales. Both spring scales read 5 N. Block C is floating as shown.



(A) Is the magnitude of the buoyant force on block B(B_B) greater than, less than, or equal to the magnitude of the buoyant force on block A(B_A)?

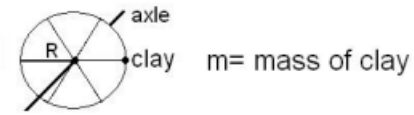
(B) Is the mass of block B (M_B) greater than, less than, or equal to the mass of block A (M_A)?

(C) Is the magnitude of the buoyant force on block C(B_C) greater than, less than, or equal to the magnitude of the buoyant force on block A(B_A)?

19. During X-Ray radiography, we usually end up with images which are dark, white, gray, or somewhere in between those regions. What does a dark region correspond to? Why?

20. How is an MRI machine better than the average X-ray radiography?(state at least two reasons)

21. A wheel of mass M and radius R is free to rotate about its own fixed horizontal axis. A small lump of clay mass m is attached to its rim as shown below. Express the magnitude of the torque in terms of m, M, and R.



Multiple Choice Answer Box

1._____	6._____	11._____
2._____	7._____	12._____
3._____	8._____	13._____
4._____	9._____	14._____
5._____	10._____	15._____