

## TSOKOS READING ACTIVITY

### Option B-3

1. Essential Idea: Fluids cannot be modelled as point particles. Their distinguishable response to compression from solids creates a set of characteristics that require an in-depth study.
2. Nature Of Science:
  - a. Human understandings: Understanding and modelling fluid flow has been important in many technological developments such as designs of turbines, aerodynamics of cars and aircraft, and measurement of blood flow.
3. International-Mindedness: Water sources for dams and irrigation rely on the knowledge of fluid flow. These resources can cross national boundaries leading to sharing of water or disputes over ownership and use.
4. Theory Of Knowledge:
  - a. The mythology behind the anecdote of Archimedes' "Eureka!" moment of discovery demonstrates one of the many ways scientific knowledge has been transmitted throughout the ages.
  - b. What role can mythology and anecdotes play in passing on scientific knowledge?
  - c. What role might they play in passing on scientific knowledge within indigenous knowledge systems?
5. Understandings:
  - a. Density and pressure
  - b. Buoyancy and Archimedes' principle
  - c. Pascal's principle
  - d. Hydrostatic equilibrium
  - e. The ideal fluid
  - f. Streamlines
  - g. The continuity equation
  - h. The Bernoulli equation and the Bernoulli effect
  - i. Stokes' law and viscosity
  - j. Laminar and turbulent flow and the Reynolds number
6. Applications And Skills:
  - a. Determining buoyancy forces using Archimedes' principle
  - b. Solving problems involving pressure, density and Pascal's principle
  - c. Solving problems using the Bernoulli equation and the continuity equation

- d. Explaining situations involving the Bernoulli effect
  - e. Describing the frictional drag force exerted on small spherical objects in laminar fluid flow
  - f. Solving problems involving Stokes' law
  - g. Determining the Reynolds number in simple situations
7. Guidance:
- a. Ideal fluids will be taken to mean fluids that are incompressible and non-viscous and have steady flows
  - b. Applications of the Bernoulli equation will involve (but not be limited to) flow out of a container, determining the speed of a plane (pitot tubes), and venturi tubes
  - c. Proof of the Bernoulli equation will not be required for examination purposes
  - d. Laminar and turbulent flow will only be considered in simple situations
  - e. Values of  $R < 103$  will be taken to represent conditions for laminar flow
8. Data Booklet Reference:
- a.  $B = \rho_f V_f g$
  - b.  $P = P_0 + \rho_f g d$
  - c.  $Av = \text{constant}$
  - d.  $\frac{1}{2} \rho v^2 + \rho g z + p = \text{constant}$
  - e.  $F_D = 6\pi\eta r v$
  - f.  $R = \frac{vr\rho}{\eta}$
9. Utilization:
- a. Hydroelectric power stations
  - b. Aerodynamic design of aircraft and vehicles
  - c. Fluid mechanics is essential in understanding blood flow in arteries
  - d. Biomechanics (see Sports, exercise and health science SL sub-topic 4.3)
10. Aims:
- a. Aim 2: fluid dynamics is an essential part of any university physics or engineering course
  - b. Aim 7: the complexity of fluid dynamics makes it an ideal topic to be visualized through computer software
11. Read Option B-3 in your textbook.
12. Write a definition for each of the terms listed below. ***Include all equations where appropriate.***
- a. Atmospheric pressure
  - b. Manometer
  - c. Total pressure in a fluid
  - d. Pascal's principle
  - e. Archimedes' principle

- f. Assumptions for an ideal fluid:
    - i. Steady
    - ii. Incompressible
    - iii. Non-viscous
  - g. Equation of continuity
  - h. Density
  - i. Bernoulli equation
  - j. Bernoulli effect
  - k. Pitot-Prandtl tube
  - l. Stokes' law
  - m. Viscosity
  - n. Terminal speed
  - o. Turbulent flow
  - p. Reynolds number
13. This assignment may be typed or neatly printed. Drawings may be freehand, but try to make use of the 'Shapes' or 'Insert Clipart' functions of MS Word. If you submit this assignment electronically, the filename must be in the following format, "LastnameFirstinitialPerXReadActX-X". You do not need to include a copy of these instructions with the assignment you hand in.