Unit 3 Quiz

1. A flow is always laminar if its Reynolds number is below a critical threshold. What is the value of this critical threshold?
A. 2,100
B. 10,000
C. 50,000
D. 200,000

2. What is the physical significance of the Nusselt number?

3. What is the relationship between the Nusselt number and the thickness of the boundary layer?

4. Repeat Example 6.2 on page 287 in Lienhard and Lienhard's *A Heat Transfer Textbook.* What would be the thickness of the boundary layer 1 m from the leading edge?

5. What is the physical significance of the Prandtl number?

6. What are the typical values of the Prandtl number for simple monatomic gases and liquid metal?

7. For a laminar flow with Pr = 2, what is the ratio between the thickness of the thermal boundary layer δ_t and the thickness of the convective boundary layer δ?

8. Write down how Nu_x might depend on Re_x for a laminar two-dimensional boundary layer on a flat surface with constant surface temperature and Pr = 8.

9. What is the Péclet number Pe_x, and how does the Nusselt number Nu_x correlate with Pe_x for a low-Pr liquid flowing over a flat plate?

10. What is Reynold's analogy?

11. For a turbulent boundary layer with $Re_x = 10^6$ and Pr = 2.5, what is the Nusselt number Nu_x?

12. Calculate the Nusselt number Nu_D for a fully developed laminar pipe flow.

13. Liquid with thermal conductivity *k* of 0.6 W/m flows through a small tube of diameter of 1 mm. The flow is laminar and fully developed. Calculate the heat transfer coefficient on the wall.

14. How does the length of thermal entrance region depend on Re and Pr for a laminar pipe flow with constant wall temperature?

15. Define Grashof number.

16. How does Rayleigh number relate to Pr number and Grashof number?