

2018 Captains Tryouts: Hovercraft

~NCSSM, NC~



You Have 50 Minutes.

Good Luck! You Got This :)

School Name: _____

Team Number: _____

Competitors' Names: _____ & _____

1. State Newton's Laws of Motion.
2. In the United States, the majority of homebuilt hovercraft tended to use the non-flow bag skirt, the simplest of skirts and the most rugged. However, bag skirts have a tendency to:
 - a. Bounce
 - b. Crack
 - c. Warp
 - d. Melt
 - e. Scream
3. A _____ is a particle which moves with a relativistic speed; that is, a speed comparable to the speed of light. A _____ is one whose velocity is small with respect to that of light. What is the difference between a non-relativistic and relativistic particle?
4. _____ Law states that when there is an increase in pressure at any point in a confined _____ fluid, there is an equal increase at every other point in the container.
5. A projectile has how many forces acting on it?
 - a) 1
 - b) 2
 - c) 3
 - d) >3
6. _____ refers to the specifically upward force exerted by a liquid or gas on an object immersed in it, while _____ is simply defined as the resistance of a liquid or gas to flow.
7. If a 1 kg SciOly binder and a 2 kg broken hovercraft fall in a vacuum they would:
 - a. Both be weightless
 - b. Experience the same acceleration
 - c. Have the same inertia
 - d. Feel the same force of gravity
8. What is the specific gravity of water?
 - a) 0
 - b) 1
 - c) 2
 - d) -1
9. On Saturday 14 March 1964, the first hovercraft race was held in _____ .
 - a. Hawaii
 - b. Germany
 - c. Wisconsin

- d. New York
 - e. Australia
10. What type of fluids become more viscous over time when shaken?
- a. Shear-thickening
 - b. Shear-thinning
 - c. Thixotropic
 - d. Rheopectic
11. When a heavy football player and a light one run into each other, which player hits the other with more force? Explain. Which one is hurt more by the collision? Explain.
12. An open-tube mercury manometer is used to measure the pressure in an oxygen tank. When the atmospheric pressure is 1040 mbar, what is the absolute pressure (in Pa) in the tank if the height of the mercury in the open tube is 28.0 m higher than the mercury in the tube connected to the tank?
13. An object has a kinetic energy of 7300J and weighs 23 kgs. What is its speed?
14. What does Bernoulli's principle state?
15. A solid object of a material with a density of 4000 kg/m³ has a volume of 0.002 m³ and thus a mass of 8 kg. How much force do you need to exert to support this object
- a. In air.
 - b. When it is completely submerged in water.
- The density of water is 1000 kg/m³. Use $g=10 \text{ m/s}^2$ in this problem.
16. In a hydraulic system, a piston with a cross-sectional area of 29 square centimeters pushes on an incompressible liquid with a force of 73 newtons. The far end of the hydraulic pipe connects to a second piston with a cross-sectional surface area of 253 square centimeters. What is the force on the second piston?
17. A piston that is part of a hydraulic system has a surface area of 0.023 square meters. The hydraulic fluid pushes on the piston with a pressure of 30,000 pascals. What pressure pushes on another piston in the same system?
18. What does SR.N1 stand for? Who was the third man on the crew (neither the pilot nor navigator) and why was he there?
19. A projectile is shot across level ground at angle $\theta = 30^\circ$ from the vertical and with initial velocity 15 m/s. Assuming negligible resistance, how far did it travel along the field?
20. Two objects, A and B, collide. A is initially moving at $v = +40\text{m/s}$, and B is initially moving at $v = -10\text{m/s}$. A and B have mass 17 kg and 23 kg respectively. The collision is perfectly inelastic and without friction. What is the final velocity of B?

21. A rigid homogeneous stick of length 2m is thrown upwards in a uniform gravitational field. At the moment when its angular kinetic energy equaled the translational kinetic energy, the stick's center of mass had velocity 5 m/s. Find the instantaneous angular velocity upon its release. Assume air resistance is negligible.
22. You are at a party with a hanging unicorn pinata. The same type of string that the pinata is hanging from is also hanging from the bottom of the pinata. For some strange reason to break the pinata you must break the top string which will result in the pinata falling and breaking open! You want to use as little force as possible to break the pinata. Should you give the bottom string a sudden downward pull or a slow continuous pull? Explain.
23. Your 15kg backpack is lying on your frictionless desk. Physics is hard so in a fit of rage you shove your backpack for 2 seconds. It reaches a velocity of 3 m/s. What was the impulse acting on your backpack?
24. A car travels with an initial speed of 70.00m/s. At $t=0$ s, it begins to accelerate at -3.200 m/s^2 . How far does the car travel before it reaches a velocity of 0m/s?
25. A rock is shot up vertically upward from the edge of the top of the building. The rock reaches its maximum height 2 s after being shot. Then, after barely missing the edge of the building as it falls downward, the rock strikes the ground 8 s after it was launched. Find the upward velocity the rock was shot at.
26. Two objects, A and B, collide. A is initially moving at $v = +20\text{m/s}$, and B is initially moving at $v = -30\text{m/s}$. A and B have mass 10 kg and 8 kg respectively. The collision is perfectly elastic and without friction. What is the final velocity of A?
27. What does LCAC stand for? Give an example of a region of the sea that LCAC's were able to cross that regular sea vessels are not.
28. Amateur naturalist Timothy Treadwell once said, "Now, the bears I live with average, the males, eight to twelve hundred pounds [360 to 540 kg]. They're the largest bears in the world.... They've been clocked at 41 [mph] and they've run a hundred meter dash in 5.85 seconds, which a human on steroids doesn't even approach." Compute the kinetic energy of a grizzly bear. (Use averages.)