Physics 103 Spring 2011 CQZ 1 **Student Name** _____ **B**

$\sigma := \frac{F}{A}$ $\sigma := Y \cdot \frac{\Delta L}{L}$ Y = Young Modulus $\tau := \frac{F}{A}$ $\tau := S \cdot \frac{\Delta x}{h}$ S=shear modulus

$\Delta P := -B \cdot \frac{\Delta V}{V}$ where B = Bulk modulus $1Pa := \frac{1N}{1m^2}$

$\rho := \frac{M}{V}$ $P := \frac{F}{A}$ pressure at some depth $P := P_o + \rho \cdot g \cdot h$ $1atm := 1.013 \cdot 10^5 Pa$

buoyant force $B := \rho_{fluid} \cdot V_{fluid} \cdot g$ continuity $A_1 \cdot v_1 = A_2 \cdot v_2$ Bernoulli $P + \frac{1}{2} \cdot \rho \cdot v^2 + \rho \cdot g \cdot y = constant$

Fahrenheit $T_F := \frac{9}{5} \cdot T_C + 32$ Celsius $T_C := \frac{5}{9} \cdot (T_F - 32)$ Kelvin $T := T_C + 273.15$

1 Liter = 10^{-3} m^3 $V_{cube} = a^3$ Acircle = πr^2 Circumference = $2 \pi r$

$\Delta L := \alpha \cdot L_o \cdot \Delta T$ $\Delta A := 2 \cdot \alpha \cdot A_o \cdot \Delta T$ $\Delta V := 3 \cdot \alpha \cdot V_o \cdot \Delta T = \beta \cdot V_o \cdot \Delta T$ Avogadro $N_A := 6.02 \cdot 10^{23}$

g = 9.8 m/s^2

$m_{atom} := \frac{molar\_mass}{N_A}$ $P \cdot V = n \cdot R \cdot T$ n = fraction or multiple of mol R = 8.31 J/mol K

As a student at NJIT I _____, will conduct myself in a professional manner understand that I must subscribe to the following pledge on major work submitted for credit as described in the NJIT Academic Honor Code:
On my honor, I pledge that I have not violated the provisions of the NJIT Academic Honor Code.

Instructions:

- Be sure your name and section number are on both the Scantron form and the question book.
- There are **20** multiple choice questions on this exam, all worth the same number of points.
- Answer each question on the Scantron sheet using a #2 pencil. You will need to do calculations on the exam papers for most of the questions: use the backs for extra space.
- A default formula sheet is provided at the top of this page. Otherwise, this is a closed book exam. Calculators are allowed.
- If you have questions or need something call your proctor or instructor.
- As you know, NJIT has a zero-tolerance policy for ethics code violations. Students are not to communicate with each other once the exam has started. All cell phones, pagers, or similar electronic devices must be turned off. Sharing of calculators is not permitted.

1. What is the absolute pressure 50 m below the sea surface? (density of sea water is 1050 kg/m^3)

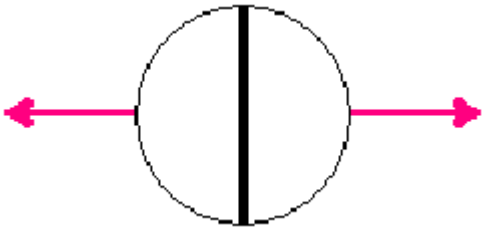
p_o = 1atm = 1.013*10^5 Pa

A. 2 atm
B. 3 atm
C. 4 atm
D. 5 atm
E. 6 atm

2. To obtain the absolute pressure from the gauge pressure:
A. subtract the atmospheric pressure
B. add atmospheric pressure
C. subtract 273
D. add 273
E. convert to N/m^2

3. In 1654, Otto von Guericke demonstrated the effect of air pressure by placing together two hemispherical steel shells with diameter of about 0.8 m and pumping out the air from the enclosed volume. He then had two teams of eight horses pull in opposite direcitons on the hemispheres in an attempt to separate the shells. With what force would each team of horses have had to pull to break apart the shells?

A 5,000 N
B 10,000 N
C 25,000 N
D 50,000 N
E 100,000 N

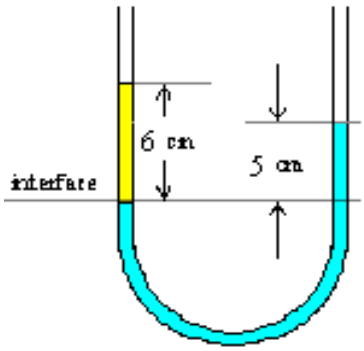


4. A styrofoam slab of size 0.25-m x 0.15-m x 2-m and mass 12 kg just floats awash in fresh water when a 75 kg swimmer is aboard. What is the buyoant force exerted on the slab?

A 500 N
B 550 N
C 600 N
D 750 N
E 850 N

5. A simple open U-tube contains water. When H = 6 cm of oil, of unknown density, is poured into the left arm of the tube, the water level in the right arm is h = 5 cm above the interface. What is the density of the oil? (The density of water is 1 g/cm^3)

A. 0.27 g/cm^3.
B. 0.52 g/cm^3.
C. 0.63 g/cm^3.
D. 0.83 g/cm^3.
E. 1.00 g/cm^3.



6. A solid has a volume of 90 cm^3. When weighed on a spring scale, the scale indicates 7 N. What does the scale indicates if the object is weighed while immersed in a liquid of density 2000 kg/m^3

A. 2.2 N
B. 3.2 N
C. 4.2 N
D. 5.2 N
E. 6.2 N

7. A hydraulic press has one piston of diameter 10 cm and other piston of diameter 20 cm. If 100 N force is applied to the smaller piston, the force exerted on the larger piston will be

A. 6.25 N
B. 25 N
C. 100 N
D. 400 N
E. 1600 N

8. One end of a cylindrical pipe has a radius of 1.5 cm. Water streams steadily out at 10 m/s. The volume flow rate is

A. 7.1×10^{-3} m^3/s
B. 9.0×10^{-3} m^3/s
C. 49×10^{-3} m^3/s
D. 70×10^{-3} m^3/s
E. 180×10^{-3} m^3/s

9. A constriction in the pipe reduces its diameter from 5.0 cm to 2.0 cm. Where the pipe is wide the fluid velocity is 8.0 m/s. Where it is narrow the fluid velocity is

A. 20 m/s
B. 35 m/s
C. 50 m/s
D. 80 m/s
E. 120 m/s

10. A cylindrical air duct is used to replenish the air of a room of volume 240 m^3 every 20 min (1200 s). The air flow in the duct at 5 m/s? What is the radius of the air duct?

A. 5 cm
B. 11 cm
C. 16 cm
D. 30 cm
E. 35 cm

11. Water (density = 1000 kg/m^3) flows through a horizontal tapered pipe. At the wide end its speed is 3.0 m/s and

at the narrow end it is 5.0 m/s. The difference in pressure between the two ends is:

A. $2x10^2$ Pa

B. $7x10^2$ Pa

C. $2x10^3$ Pa

D. $4.5x10^3$ Pa

E. $8x10^3$ Pa

12. Room temperature is about 20 degrees on the :

A. Kelvin scale

B. absolute scale

C. Celsius scale

D. Fahrenheit scale

E. none of the above

13. A water line enters a house 2 m below ground. A smaller diameter pipe carries water to a faucet 5 m above the ground, on the second floor. Water flows at 2 m/s in the main line and at 7 m/s on the second floor. If the pressure in the main line is 2×10^5 Pa, then the pressure on the second floor is:

A. 5.3×10^4 Pa

B. 1.1×10^5 Pa

C. 1.5×10^5 Pa

D. 2.5×10^5 Pa

E. 3.4×10^5 Pa

14. A metal rod 40.0000 cm long at 40°C is heated to 60°C. The length of the rod is then measured to be 40.0105 cm. What is the coefficient of linear expansion of the metal?

A. 13×10^{-6}/C°

B. 22×10^{-6}/C°

C. 44×10^{-6}/C°

D. 53×10^{-6}/C°

E. 71×10^{-6}/C°

15. The coefficient of volume expansion of iron is 3×10^{-5} per ^{0}C. The volume of the iron cube, 5 cm on edge, will increase by what amount if it is heated from 10^0C to 65^0C?

A. 0.00375 cm^3

B. 0.206 cm^3

C. . 0.0225 cm^3

D. . 0.00125 cm^3

E. . 0.0625 cm^3

16. A cube of aluminum is 20 cm on edge. Aluminum has a density of 2.7 g/cm^3 and a specific heat of 0.217

cal/g^{0}C. The heat in calories needed to raise the temperature of the cube from 200^0 to 300^{0}C is about:

A. 27 cal
B. 37 cal
C. 47 cal
D. 270000 cal
E. 470000 cal

17. The heat given off by 0.3 kg of an alloy as it cools through 50^{0}C raises the temperature of 0.3 kg of water (specific heat = 4186 J/kg^{0}C) from 30^{0}C to 40^{0}C . The specific heat of the alloy (in J/kg^{0}C) is:

A. 25 J/kg^{0}C
B. 241 J/kg^{0}C
C. 356 J/kg^{0}C
D . 837 J/kg^{0}C
E. 983 J/kg^{0}C

1A 2B 3D 4E 5D 6E 7D 8A 9C 10B 11E 12C 13B 14A 15B 16E 17D