Midterm α, Physics 1P23/1P93

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Name	
Student ID	

No examination aids other than those specified on this examination script are permitted (FHB 5.1.2.A). Use or possession of unauthorized materials will automatically result in the award of a zero grade for this examination.

This is a closed–book test, only calculators are allowed
Formulas not on the supplied formula sheet must be derived

Attempt all questions

Question	Mark	Out of
1	a b c d	2
2	a b c d	2
3	a b c d	2
4	a b c d	2
5	a b c d	2
6		10
7		10
Total		30

This exam contains 3 pages. Please, verify that your copy is complete.

For questions 1–4: circle the correct answer **on the cover page**.

(2) **1**. A flask of water rests on a scale. If you dip your finger into the water, without touching the flask, the reading on the scale will

a. decrease.

b. stay the same.

c. increase.

d. increase or decrease depending on the density of your finger.

(2) **2**. An industrial fabrication process stamps out thin metal pieces, each in the shape of a square with a circular hole in the middle, from a large thin sheet. These pieces are mounted in a large machine. As these pieces heat up during regular machine operation, the diameter of the circular hole will

a. increase.

b. stay the same.

c. decrease.

d. behave unpredictably causing the machine to malfunction.

(2) **3**. The Bernoulli effect is responsible for the lift force on an airplane wing. Wings must therefore be designed so that

a. air molecules are deflected downward when they hit the wing.

b. air molecules move more rapidly past the upper surface of the wing than past the lower surface.

c. air molecules move more rapidly past the lower surface of the wing than past the upper surface.

d. wings are thick enough to create a significant pressure difference between the top and bottom surfaces of the wings because of the different heights of the air columns above them.

(2) **4**. An ideal gas is confined to a container with adjustable volume. The number of moles and temperature are constant. By what factor will the pressure change when volume doubles?

a. $\frac{1}{4}$

b. $\frac{1}{2}$

c. 2

d. 4

(2) **5**. Object 1 has four times the specific heat capacity and three times the mass of Object 2. The two objects are given the same amount of heat. If the temperature of Object 1 changes by an amount ΔT_1, then the change in temperature of Object 2 is:

a. $\Delta T_2 = \frac{1}{12}\,\Delta T_1$

b. $\Delta T_2 = \frac{3}{4}\,\Delta T_1$

c. $\Delta T_2 = \frac{4}{3}\,\Delta T_1$

d. $\Delta T_2 = 12\,\Delta T_1$

(10) **6**. Motor oil, with a viscosity of 0.250 Ns/m^2, is flowing through a tube that has a radius of 3.00 mm and is 1.00 m long. The difference in pressure between the two ends of the tube is 300 kPa. How long does it take to fill a 1-gal (1 gal=3.79 l) container with oil?

(10) **7**. An aluminum rod is 10.0 cm long and a steel rod is 80.0 cm long when both rods are at a temperature of 15°C. Both rods have the same diameter. The rods are joined end-to-end to form a rod 90.0 cm long. The coefficients of linear expansion of aluminum and steel are $\alpha_{\rm Al} = 2.4 \times 10^{-5}$ K^{-1} and $\alpha_{\rm steel} = 1.2 \times 10^{-5}$ K^{-1}, respectively. As the temperature is raised to 90°C, what is the increase in the length of the joined rod, in mm? What is the effective coefficient of linear expansion, $\alpha_{\rm eff}$ of this combination rod?