Your code is:

Put your name here:

Keep this exam **CLOSED** until advised by the instructor.

60 minute long closed book exam.

Fill out the bubble sheet: last name, first initial, student number, section number and **code**.

A two-sided 8.5 by 11 handwritten help sheet is allowed.

When done, hand in your **test** and your **bubble sheet**.

Thank you and good luck!

Possibly useful constants:

- g = 9.81 m/s^2
- G = 6.67$\times 10^{-11}$ Nm^2/kg^2
- σ = 5.67 $\times$ 10^{-8} W/(m^{2}K^4)
- R= 0.0821 L*atm/(mol*K) = 8.31 J/(mol*K)
- density of fresh water = 1000 kg/m^3

Possibly useful Moments of Inertia:

- Solid homogeneous sphere: $I_{CM} = (2/5)MR^2$
- Thin spherical shell: $I_{CM} = (2/3)MR^2$
- Thin uniform rod, axis perpendicular to length: $I_{CM} = (1/12)ML^2$
- Solid homogeneous cylinder or disk, axis through center of mass and parallel to length: $I_{CM} = (1/2)MR^2$

Latent Heats and Phase Change Temperatures of some Materials (at atmospheric pressure)

	Melting		**Boiling**	
Material	**T_f (K)**	**L_f(J/g)**	**T_v (K)**	**L_v(J/g)**
Alcohol	159	100	351	850
Copper	1356	207	2868	4730
Gold	1336	64.5	2933	1580
Helium	-	-	4	21
Hydrogen	14	58.0	20	455
Lead	601	23.2	2017	858
Mercury	234	11.4	630	296
Nitrogen	63	26	77	200
Oxygen	54	13.9	90	213
Silver	1235	105	2323	2336
Tungsten	3783	180	6170	4820
Water	273	333	373	2263

Specific Heats of some Materials (at room temperature and atmosperic pressure unless otherwise noted)

Material	**c [J/kg· C]**	**c [kcal/kg· C]**
Air (at 50 ·C)	1050	0.25
Alcohol	2430	0.58
Aluminum	920	0.22
Copper	390	0.093
Glass	840	0.20
Granite	790	0.19
Ice (at -10 ·C)	2220	0.53
Iron, Steel	460	0.11
Lead	130	0.031
Mercury	140	0.033
Seawater	3900	0.93
Silver	240	0.056
Soil, Dirt	1000	0.24
Steam (110 ·C)	2010	0.48
Tungsten	135	0.032
Water	4186	1 exactly
Wood	1680	0.40

9 pt The speed of sound in air is 344 m/s. If an audible sound has a frequency of 3000 Hz, what is its wavelength in meters?

1.A◯ 6.48×10^{-2} **B**◯ 8.62×10^{-2} **C**◯ 1.15×10^{-1}
D◯ 1.53×10^{-1} **E**◯ 2.03×10^{-1} **F**◯ 2.70×10^{-1}
G◯ 3.59×10^{-1} **H**◯ 4.77×10^{-1}

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9 pt A block of mass 0.29 kg connected to a spring with spring constant 31 N/m is oscillating on a frictionless horizontal surface. Its speed as it passes through its equilibrium position is 3.3 m/s. What is the total energy of the system in J?

2.A◯ 1.15 **B**◯ 1.35 **C**◯ 1.58 **D**◯ 1.85
E◯ 2.16 **F**◯ 2.53 **G**◯ 2.96 **H**◯ 3.46

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9 pt Identify the statements as being either True or False.

▷ A force of 5.0 N is applied to a 20 kg mass on a horizontal frictionless surface. As the speed of the mass increases at a constant acceleration, the power delivered to it by the force remains the same.

3. **A**◯ True **B**◯ False

▷ Two blocks are released from the top of a building. One falls straight down while the other slides down a smooth ramp. If all friction is ignored, the block that went straight down will have a greater speed when it reaches the bottom than the block that went down the ramp will have when it reaches the bottom.

4. **A**◯ True **B**◯ False

▷ A train moves at a constant speed of 60 mph. A cannon is stationed on a flatcar moving with the train. The cannon has a muzzle velocity of 120 mph. If the gunner aims the cannon straight up and fires a cannonball, the kinetic energy of the cannonball at its highest point will be greater than zero.

5. **A**◯ True **B**◯ False

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6 pt Some curious students hold a rolling race by rolling four items down a steep hill. The four items are a solid homogeneous sphere, a thin spherical shell, a solid homogeneous cylinder and a hoop with all its mass concentrated on the hoop's perimeter. All of the objects have the same mass and start from rest. Assume that the objects roll without slipping and that air resistance and rolling resistance are negligible. For each statement below, select True or False.

▷ Upon reaching the bottom of the hill, the homogeneous sphere will have a smaller rotational kinetic energy than any of the other objects will when they reach the bottom of the hill.

6. **A**◯ True **B**◯ False

▷ The hollow sphere will reach the bottom before the solid sphere.

7. **A**◯ True **B**◯ False

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9 pt Identify the statements as being either True or False.

▷ A freely rotating solid disk will speed up when heated.

8. **A**◯ True **B**◯ False

▷ The temperature measured in °C can be less than the temperature measured in °F.

9. **A**◯ True **B**◯ False

▷ In a mixture of He and Ne at equillibrium, SOME of the Ne atoms move faster than SOME of the He atoms.

10. **A**◯ True **B**◯ False

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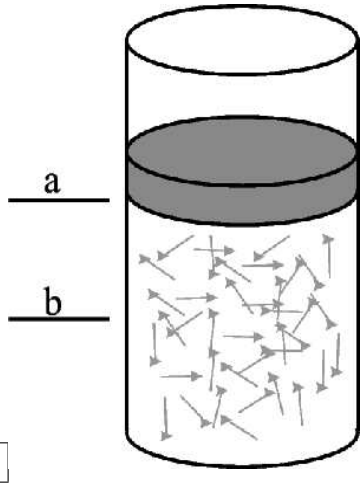
9 pt A constant volume gas thermometer has a pressure of 1180 Pa at 15 °C. What would the pressure be for -62 °C (in Pa)?

11.A◯ 6.42×10^{1} **B**◯ 9.30×10^{1} **C**◯ 1.35×10^{2}
D◯ 1.96×10^{2} **E**◯ 2.84×10^{2} **F**◯ 4.11×10^{2}
G◯ 5.96×10^{2} **H**◯ 8.65×10^{2}



6 pt

▷ A massive piston traps a fixed amount of helium gas as shown. After being brought to point (a) the system equilibrates at room temperature. The gas is then cooled gas isobarically compressing the gas to half of its original volume (b). The internal energy of the gas at "b" is _____ the internal energy of the gas at "a".

12. **A**◯ greater than **B**◯ equal to
C◯ less than

▷ A massive piston traps a fixed amount of helium gas as shown. After being brought to point (a) the system equilibrates at room temperature. The gas is then cooled gas isobarically compressing the gas to half of its original volume (b). The entropy of the gas at "b" is _____ the entropy of the gas at "a".

13. **A**◯ greater than **B**◯ equal to
C◯ less than

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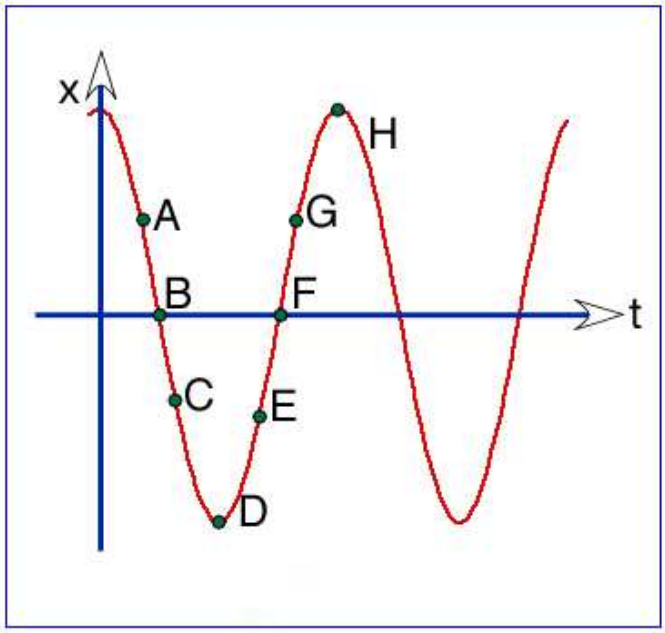
9 pt A gas is compressed at a constant pressure of 0.721 atm from 9.81 L to 5.91 L. During the process, 470 J of energy leaves the gas by heat. What is the change in the internal energy of the gas? (in J)

14.**A**◯ -164 **B**◯ -185 **C**◯ -209 **D**◯ -236
E◯ -267 **F**◯ -302 **G**◯ -341 **H**◯ -385



16 pt

The figure above is a position versus time graph of an object undergoing simple harmonic motion. Positive values of x are plotted above the t axis. For each statement below, answer True or False.

▷ The velocity has its largest negative value at B.
15. **A**◯ True **B**◯ False

▷ The velocity at F is zero.
16. **A**◯ True **B**◯ False

▷ The acceleration at B is zero.
17. **A**◯ True **B**◯ False

▷ The acceleration has its largest positive value at D.
18. **A**◯ True **B**◯ False

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9 pt
Two blocks of metal come into contact with one another. Given the following data:

Block one
Specific heat = 0.131 kcal/(kg°C)
Mass = 0.118 kg
Initial temperature = 15 °C

Block two
Specific heat = 0.11 kcal/(kg°C)
Mass = 0.161 kg
Initial temperature = 77 °C
What is the final temperature (in °C) of the two blocks after they reach equilibrium?

19.**A**◯ 45.7 **B**◯ 46.0 **C**◯ 48.1 **D**◯ 48.2
E◯ 50.5 **F**◯ 50.8 **G**◯ 62.0 **H**◯ 92.0

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9 pt A styrofoam cooler (K = .030 W/m^o C) has an average surface area of 0.501 m^2 and an average thickness of 2.0 cm. About how long, in seconds will it take for 3.60 kg of ice at 0^{o}C to melt in the cooler if the outside temperature is 24.0^{o}C?

20.**A**◯ 3.40×10^4 **B**◯ 4.25×10^4 **C**◯ 5.31×10^4
D◯ 6.64×10^4 **E**◯ 8.30×10^4 **F**◯ 1.04×10^5
G◯ 1.30×10^5 **H**◯ 1.62×10^5