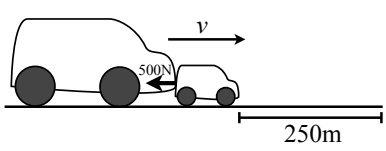
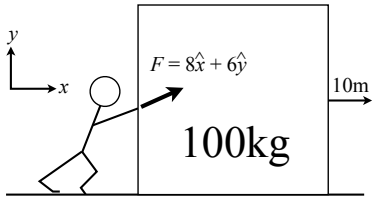
Physics 101 Name:_____

New Stuff **Sample Exam 3** 13 questions, 51 points

1. A large car pushes a small car for 250 m to the right. The **small car** exerts a force of $F = 500\,\text{N}$ on the large car. What work does the **small car** do on the large car?



2. A force of $\vec{F} = 8\hat{x} + 6\hat{y}\,\text{N}$ is applied to a block, as it moves 10 m over the ground.



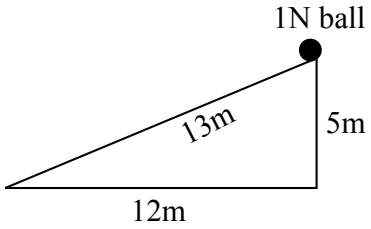
[3] (a) _____ How much work is done on the block by that force?

A) $-100\,\text{J}$ **B)** $-80\,\text{J}$ **C)** $-20\,\text{J}$
D) $+100\,\text{J}$ **E)** $+80\,\text{J}$ **F)** $+20\,\text{J}$

[2] (b) If the mass is 100 kg, starts at rest, and is sitting on a frictionless surface, what is its kinetic energy after it has been pushed 10 m?

3 3. _____ A ball with weight $mg = 1\,\text{N}$ rolls down the ramp shown. What is the change in its potential energy once it reaches the bottom?

A) $-5\,\text{J}$ **B)** $-12\,\text{J}$ **C)** $-13\,\text{J}$
D) $+5\,\text{J}$ **E)** $+12\,\text{J}$ **F)** $+13\,\text{J}$

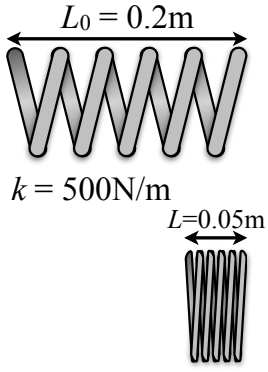


3 4. _____ 25 W is applied to a block for 5 s. How much energy is provided?

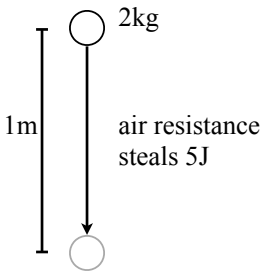
A) 5 J **B)** 25 J **C)** 125 J

3 5. _____ A spring has a relaxed length of 0.2 m and a spring constant of 500 N/m. If the spring is compressed so that its length is 0.05 m, what is the potential energy of the spring?

A) $-75\,\text{J}$ **B)** $-5.6\,\text{J}$ **C)** 0.63 J
D) 5.6 J **E)** 25 J **F)** 75 J



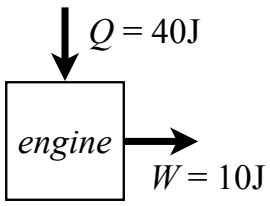
[4] 6. A 2 kg ball is dropped from the top of a building. It falls for 1 m, during which time air resistance does -5 J of work. How fast is the ball moving at the end of this motion?



[3] 7. _____ Why is it impossible to create an engine with 100% efficiency?

A) It would violate conservation of energy.
B) It would be very slow.
C) It would result in a decrease of disorder (or entropy).

8. A heat engine takes in 40 J of heat every second and does 10 J of work.



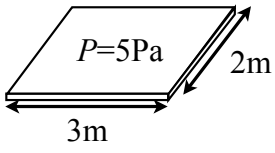
3 (a) _____ What is the efficiency of this engine?

A) 10% **B)** 20% **C)** 25% **D)** 33% **E)** 75%

3 (b) _____ How much heat is expelled into the cold reservoir?

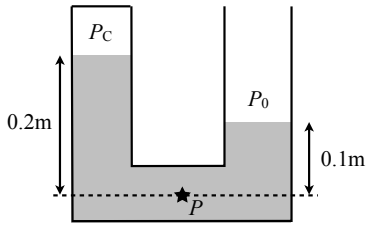
A) 10 J **B)** 20 J **C)** 30 J **D)** 40 J **E)** 50 J

3 9. _____ If I apply a 5 Pa pressure evenly on a 2 m by 3 m surface, what is the net force F that I (not the atmosphere) apply to the surface?



A) 0.83 N **B)** 1.2 N **C)** 25 N **D)** 30 N **E)** 6×10^5 N

10. A tube is closed on the left end, and open to the atmosphere on the right end. The tube is partially filled with water with density $\rho = 1000\,\text{kg/m}^3$. Atmospheric pressure is $P_0 = 1.01 \times 10^5\,\text{Pa}$.



[3] (a) Suppose P is the pressure of the water at the star, 0.1 m below the level of the water in the right-hand tube. What is $P - P_0$? (This is known as the gauge pressure.)

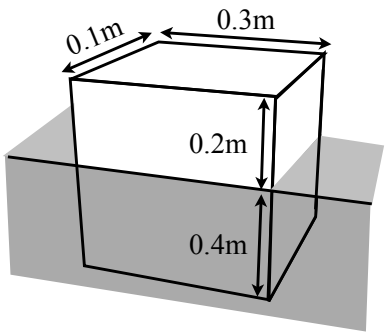
[3] (b) _____ The pressure P_C of the air at the top of the left tube is

A) less than P_0 **B)** equal to P_0 **C)** greater than P_0

[3] 11. _____ A block of wood has a mass of 500 kg and a density of $1200\,\text{kg/m}^3$. It will float in which of the following fluids?

A) Formaldehyde ($812\,\text{kg/m}^3$) **B)** Water ($1000\,\text{kg/m}^3$)
C) Bromine ($3120\,\text{kg/m}^3$) **D)** Formaldehyde and Water
E) Water and Bromine **F)** All of them **G)** None of them

12. The figure shows a block floating in water ($\rho = 1000\,\text{kg/m}^3$). The block is 0.1 m deep, 0.3 m wide, and 0.6 m tall. The block extends above the water by 0.2 m and below by 0.4 m.

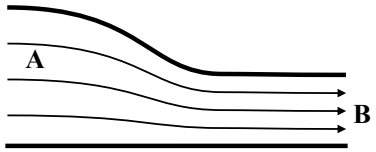


3 (a) Find the buoyancy force on the cube.

3 (b) _____ Find the density of the cube. (Hint: you don't need the block's mass.)

A) $333\,\text{kg/m}^3$ **B)** $500\,\text{kg/m}^3$ **C)** $667\,\text{kg/m}^3$ **D)** $1000\,\text{kg/m}^3$

13. Water is flowing through a narrowing pipe as shown.



2 (a) _____ At which end is the water flux Φ larger?

A) A **B)** B
C) The flux is the same at both ends

2 (b) _____ At which end is the water moving faster?

A) A **B)** B **C)** The speed is the same at both ends

2 (c) _____ At which end is the water pressure larger?

A) A **B)** B **C)** The pressure is the same at both ends