

MY SO PRACTICE TEST

DIVISION B - MIDDLE SCHOOL, GRADES 6-9

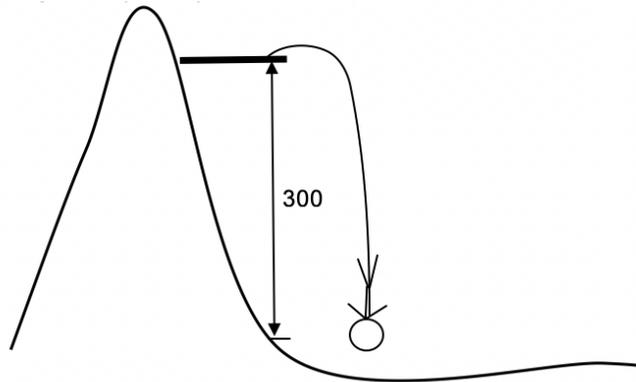
PRACTICE TEST

Instructions

- You have 20 minutes to complete this test.
- You may write your answers directly in the test.
- You may use any notes or resources you have created or collected.
- You may use a calculator and scratch paper if necessary.
- Good Luck!

Test Questions

1. You are bungee jumping from a cliff. Thanks to an elastic cord, you fall and bounce back up into the air. You reach the lowest point in your jump at 300m. What is the velocity of the jumper at that instant in time? (diagram may or may not be to scale)



- a. 7.82 m/s
 - b. 0 m/s
 - c. 30.61 m/s
 - d. None of the above
2. I throw an egg up in the sky at 10 m/s. How long does it remain in the air before I catch it at the same level where I threw it?
 - a. 1.02s
 - b. 2.04s
 - c. 2.54s
 - d. None of the above

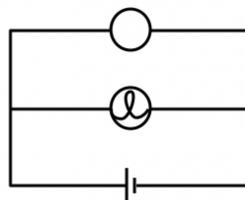
3. Laurie is sitting on a seesaw with her dog. Her dog weighs approximately 25 kg and sits 2 m away from the fulcrum. Assume Laurie weighs 65 kg. How far away from the fulcrum should she sit so that she and her dog are balanced on the seesaw?
- 2 m
 - 77 cm
 - 38 cm
 - 19 cm

Use the following information for questions 4 to 6.

Your family is going on vacay in the Caribbean! You are so excited that you packed 20 kg worth of belongings in your massless luggage. As you drag your suitcase around the airport, you start thinking about physics. Assume $g = 10 \text{ N/kg}$.

4. If you are walking at a constant speed, and use 250N of force to drag the suitcase at an angle on carpet, how much friction does the carpet have on the suitcase?
- 250N
 - 200N
 - 150N
 - 100N
5. You get bored of dragging the suitcase like that, and instead you decide to push the suitcase horizontally on the frictionless floor. You and the suitcase travel at constant speed for 5 meters. How much work is being done on the suitcase?
- 1250 J
 - 1000 J
 - 100 J
 - 0 J
6. You just boarded the plane, and now you have to put the suitcase in the compartment on top of your head. You can't reach that high, so you ask your dad for help. Your dad raises the suitcase for 2 m to put the suitcase in the compartment. How much potential energy does the suitcase gain?
- 0 J
 - 40 J
 - 400 J
 - None of the above

7. What will happen to the circuit diagrammed below?
- The lightbulb will light up.
 - It will be shorted.
 - The ammeter will have a reading.
 - None of the above.



8. You and your friends are planning a roadtrip for this summer. One leg of your road trip will be from Mount Rushmore to the Lincoln Memorial. Your GPS tells you that this trip will take approximately 24 hours by car, covering a distance of 1,628 miles. Assuming you are driving constantly, what would be your approximate average speed during this trip?
- 67.83 mph
 - 14.74 mph
 - 85.39 mph
 - 64.92 mph

9. Take into consideration air resistance for this problem. You drop a ball (1) with mass m , and you drop a ball (2) with identical shape but mass $2*m$ at the same time. Which one reaches the ground first?
 - a. Ball 1
 - b. Ball 2
 - c. Both reach the ground at the same time

10. You've designed a mechanism using a motor to power a crushing mechanism, and it gets hot after a while. Why is this?
 - a. The motor draws more current when it is working harder
 - b. The resistance of the motor increases when it is working harder
 - c. Friction has a greater effect when the motor is moving slower to crush the objects
 - d. All of the above
 - e. None of the above

11. In the engineering design process, what should you do after brainstorming possible ideas?
 - a. Start building fully complete versions of each idea to be able to compare them
 - b. Select a plausible idea and build a prototype to be able to test and evaluate the idea
 - c. Show the possible ideas to the client and have them choose one as the final design
 - d. Iterate on each potential idea until you get to a final design, then start building

12. You travel 5 meters east, 8 meters west, and then 4 meters north. Select the correct pair of total distance traveled and total displacement
 - a. Displacement: 17m Distance: 17m
 - b. Displacement: 5m Distance: 17m
 - c. Displacement: 17m Distance: 5m
 - d. Displacement: 5m Distance: 5m

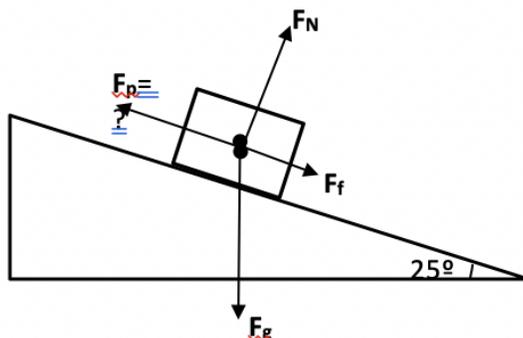
13. If you run in a straight line for 40 meters in 10 seconds, then walk in a straight line for 20 meters in 20 seconds, what is your average speed?
 - a. 1 m/s
 - b. 2 m/s
 - c. 3 m/s
 - d. 4 m/s

14. You are at the top of the McGraw Tower, which is about 52.7 meters high. You want to drop an egg that weighs 50 g out the window. (Disclaimer: don't try this in real life, no one wants to get concussions from random falling eggs!) By the time the egg falls on the ground, what is its change in potential energy? What is its change in kinetic energy? Ignore air resistance.
 - a. $\Delta PE = 25.8 \text{ kJ}$; $\Delta KE = -25.8 \text{ kJ}$
 - b. $\Delta PE = 25.8 \text{ J}$; $\Delta KE = -25.8 \text{ J}$
 - c. $\Delta PE = -25.8 \text{ kJ}$; $\Delta KE = 25.8 \text{ kJ}$
 - d. $\Delta PE = -25.8 \text{ J}$; $\Delta KE = 25.8 \text{ J}$

3

15. I picked up a 7 kg suitcase for a friend on West Campus on the bottom of the Slope at Cornell, and now I need to get it up the hill. I know that the Slope has a 25° incline and its $\mu_k=0.50$. How much force should I exert on the suitcase to push it up the hill at constant speed? The free body diagram below shows the scenario, where F_p is my pushing force, F_N is the normal force, F_g is the weight of the suitcase, and F_f is the frictional force. The diagram may or may not be to scale. ($g=9.8$ N/kg)

- a. 68.60 N
- b. 60.08 N
- c. 31.09 N
- d. 34.30 N

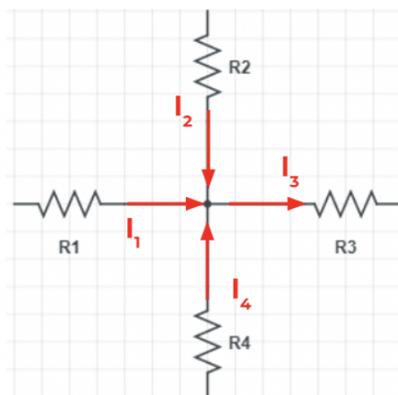


16. Which of the following are true statements stemming from Newton's Laws?
- I. A heavier object and lighter object free fall with the same acceleration (ignoring air resistance) because the force of gravity and mass both increase proportionally in $F = ma$
 - II. Two objects of different masses will accelerate at the same rate given the same force
 - III. Two people are standing on skateboards, facing each other. If the first person pushes the second, they both feel an equal force and roll backwards.
 - IV. An object moving in one direction with non-zero constant velocity has a non-zero constant acceleration.
- a. I and II
 - b. I and III
 - c. II and IV
 - d. I and IV
17. I got a 9 V battery for my ohmic flashlight, which has a resistance of 6Ω . How much current does it generate?
- a. 54 A
 - b. 15 A
 - c. 1.5 A
 - d. 0.67 A
18. What does Kirchoff's voltage law state?
- a. The voltages in a closed loop sum to 0
 - b. Each voltage drop in a closed loop is equivalent
 - c. Voltage is proportional to current times resistance
 - d. Voltage is proportional to current divided by resistance

19. If $I = 6$ and $I = I = I = x$ then what is x ?

3. 1. 2. 3

- a. 2 A
- b. 3 A
- c. 6 A
- d. 18 A



20. You use a wheelbarrow to help you lift a mound of dirt. What simple machine makes it easier for you to lift up the dirt?

- a. Lever
- b. Wedge
- c. Wheel and axle
- d. Incline plane



21. Consider this expression: "(A or B) and (A and C)" in a certain if-statement. Given that A is True and B is True and C is unknown, does the code inside the if-statement execute?

- a. Yes
- b. No
- c. Neither a) nor b)
- d. Not enough information

22. Identify the statement that is not true about loops.

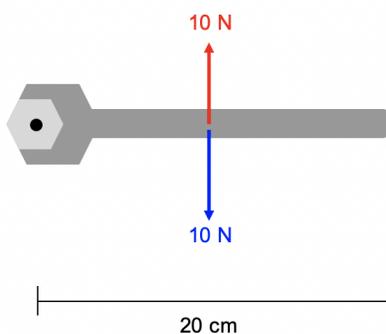
- a. Loops actually speed up execution time by reducing the number of lines of code.
- b. A while loop can be used for anything that a for loop can.
- c. It is possible for both a for loop and a while loop to run for zero iterations.
- d. A loop cannot repeatedly execute code not written within the loop body (ignore function calls to code outside the loop body).

23. How does a CNC mill manufacture a part?

- a. Builds up parts by depositing molten material
- b. Utilizes a rotating "endmill" to carve out material
- c. Using a long saw blade to carve out material
- d. Pouring molten material into a die or a mold and letting it cool

24. What is the net torque on the wrench when the following forces are applied?

- a. 0 N*m
- b. 4 N*m
- c. 10 N*m
- d. 20 N*m



25. Which of the following is the truth table for a NAND gate? (Hint: don't memorize these, just walk through it logically)

Table A:

Input 1	Input 2	Output
0	0	1
0	1	1
1	0	1
1	1	0

Table B:

Input 1	Input 2	Output
0	0	0
0	1	0
1	0	0
1	1	1

Table C:

Input 1	Input 2	Output
0	0	0
0	1	1
1	0	1
1	1	0

Table D:

Input 1	Input 2	Output
0	0	1
0	1	0
1	0	0
1	1	1

26. A hydraulic press is a machine that applies a very large compressive force onto an object. (There are lots of fun YouTube videos!) If a hydraulic press exerts 5000 N of force onto a cube with side length 0.3 m, calculate the average normal stress experienced by the cube.
- 185185.19 Pa
 - 55555.55 Pa
 - 16666.66 Pa
 - 1500 Pa
27. If the hydraulic press from the previous question compresses the cube to be 0.26 m tall, what is the normal strain?
- 0.04 / 0.26
 - 0.04 / 0.30
 - 0.26 / 0.04
 - 0.30 / 0.04
28. The hydraulic press from the previous question puts pressure on two different cubes. The first shatters into many pieces, and the second deforms. Which of the following is true about the material properties of the cubes?
- The first cube is made of a brittle material and the second is made of a ductile material
 - The first cube is made of a ductile material and the second is made of a brittle material
 - The cubes are both made of a ductile material
 - The cubes are both made of a brittle material
29. If you want to design a roof that supports a load of 60000 N with a safety factor of 3, how much load should it actually be able to support?
- 18000 N
 - 20000 N
 - 180000 N
 - 200000 N

30. You are trying to cut strips of paper that are 1 inch wide each. You cut strips that are 1.02, 1.03, 0.98, 0.96 and inches wide. Then you cut a strip that is 1.98 inches wide. How does this last strip affect your overall precision and accuracy?
- a. Increases precision, decreases accuracy
 - b. Increases accuracy, decreases precision
 - c. Decreases precision, decreases accuracy
 - d. Increases precision, increases accuracy

ANSWER KEY

- | | | | | | |
|-----|----------|-----|----------|-----|----------|
| 1. | B | 15. | B | 29. | C |
| 2. | B | 16. | B | 30. | C |
| 3. | B | 17. | C | | |
| 4. | C | 18. | A | | |
| 5. | D | 19. | A | | |
| 6. | C | 20. | A | | |
| 7. | B | 21. | D | | |
| 8. | A | 22. | A | | |
| 9. | B | 23. | B | | |
| 10. | A | 24. | A | | |
| 11. | B | 25. | A | | |
| 12. | B | 26. | B | | |
| 13. | B | 27. | B | | |
| 14. | C | 28. | A | | |



Practice Test Developed with Science Olympiad at Cornell



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