ASPIRE THINKING

Name: _____   Date:_____

Take your time to do the questions. Read the words properly and annotate wherever needed.

1. Coline was driving at 61.2 km/h when she saw a cat 50.0 m in front of her. How much must she decelerate uniformly to save the cat?

   a. 2.89 m/s^2
   b. 1.22 m/s^2
   c. 37.4 m/s^2
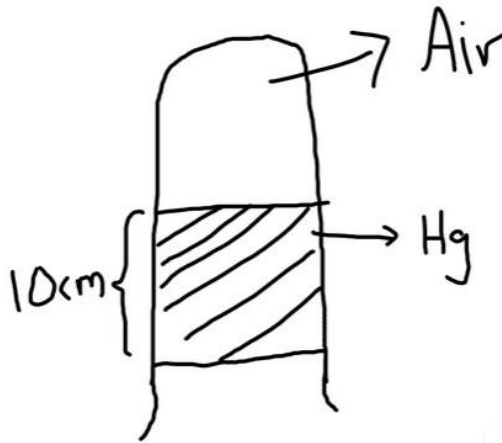   d. 74.9 m/s^2

2. Joyce's 25kg CB mentos-coke rocket took off vertically with an acceleration of 2.5 m/s^2. Find its thrust force.

   a. 62.5 N
   b. 312 N
   c. 250 N
   d. 187 N

3. Xian Hang is moving with a speed that doesn't change. Therefore, he definitely does not have acceleration.

   a. True
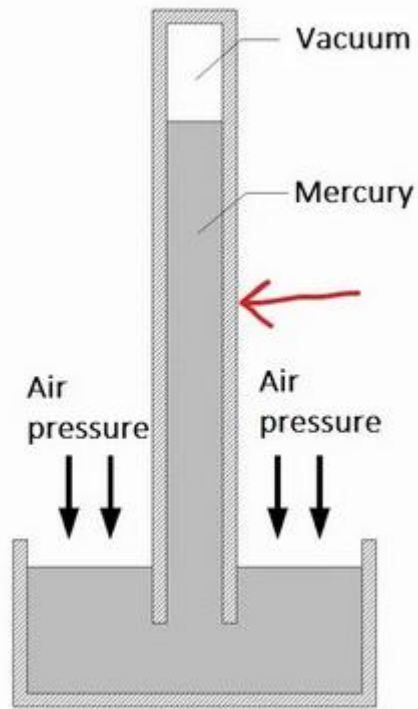   b. False

4. What is the pressure of the air in the test tube? Take P_{atm} to be 76 cmHg

a. 0 cm Hg

b. 76 cm Hg

c. 66 cm Hg

d. 86 cm Hg

5. A hole in a barometer was made at the red arrow by playful Isaac. What happens to the mercury **above the hole**?

a. It will spill out

b. It will shoot up to the top of the tube

c. Nothing will happen

d. The barometer will burst

6. Ryan and a friend (who weighs more than him) were standing on a bus when it braked sharply. Who flew forward more?

a. Ryan

b. Friend

c. Both flew the same distance forward

d. Both remained at their same position

7. Dexter was standing on the weighing scale inside a lift. The lift goes down. What happens to the reading of the scale?

    a. It increases

    b. It decreases

    c. It remains the same

    d. The scale breaks

8. An earthquake rumbled 700 times in 14 secs and produced a sea wave that travels 3.5 km in 350s. Find its wavelength.

    a. 0.2m

    b. 0.0002 m

    c. 8 m

    d. 0.0142m

9. Metal X has length 3 cm in -15 deg C ice and 105 cm in 80 Deg C water. What is the temperature when X is 25 cm?

    a. 5.49 Deg C

    b. 38.6 Deg C

    c. 35.5 Deg C

    d. 18.3 Deg C

10. Rice cooks faster in pressure cookers as water boils at a lower temperature.

    a. True

    b. False

11. Wire A is 2 times longer but 2 times larger in diameter than wire B. Therefore, their resistance will be the same.

    a. True

    b. False

12. Yuyang plugged in a 3-pin plug with its earth wire connected to the live pin instead of the earth pin. Will he be able to use his appliance?

    a. Yes

    b. No

    c. Yes but the appliance will break down soon

    d. The appliance will explode

A Parting Note

I hope you had fun doing these questions! This is what we do in Aspire Thinking – we take a look at questions that challenge our understanding of concepts and we discuss about them in class.

Over time, doubts and misunderstandings get cleared and we become more familiar with laws, formulae and applications. As a result, we get better at answering questions and thus, students score a better grade over time.

Keep looking for challenging questions to do and discuss them with your teachers or friends. Or you can come for our classes as well. Every time you work on questions, you are one step closer to scoring better.

In the next page, you will the answer key with brief explanation. Read the explanation thoroughly, especially for those questions that were answered wrongly. Sometimes you may need to read more than once. That is normal. At the end of it, you will feel yourself becoming more familiar with topic and that is what learning is about.
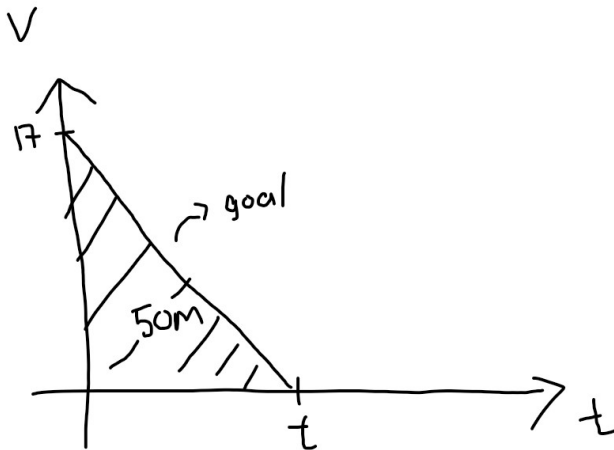
Answers and brief explanation

1. A. Practice good kinematics habit by drawing velocity- or speed-time graphs.

   By drawing a speed time graph, we have a triangle. Our goal is to find the gradient. As the answers are in m/s^2, don't forget to convert the 61.2km/h to m/s which will then be 17 m/s.
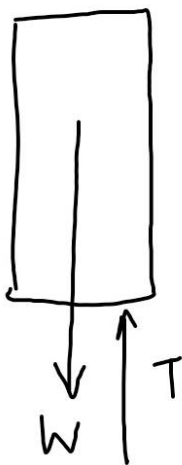

Find the t, using ½ x 17 x t = 50m (area under graph), t = 5.8823s

and then use a = (v-u)/t, a = (0-17)/5.8823s,

a =2.89 m/s^2

2. B. Practice good dynamics habit by drawing a free body diagram.

   Here is a simple one:

   T = Thrust force
   W = Weight
   a = resultant acceleration

   Applying newton's second law: T – W = ma

T – 25x10 = 25 x 2.5
T = 312 N

Remember that W is weight and not mass so you need to use W = mg = 25 x 10 N.

3. False. Uniform speed does not equal to uniform velocity. For example, Xian Hang could have been running in a circle at constant speed. Since he is running in a circle, his velocity changes as velocity depends on direction and he is constantly changing his direction. Since acceleration is defined as rate of change in velocity, he is accelerating in this case. FYI, his acceleration will always be towards the center of the circle he is running in.

4. C. The only way for the mercury and air to not 'drop out' of the test tube is that the atmospheric is supporting it → the pressure inside the test tube is equal to pressure outside of the tube. Thus, the $P_{atm} = P_{Hg} + P_{air}$, 76 = 10 + Pair and so Pair is 66 cm Hg.

5. B. When the hole is made. The tube is split into the two parts. The upper part has vacuum at the top and only a certain height of mercury which will definitely be less than 76 cm Hg since the entire length before the hole was made is 76 cm. This means the outside pressure is greater than the inner pressure of the upper part. The net pressure will create a net force that pushes the upper mercury up to the top of the tube.

6. B. This question is about inertia. Since Ryan's friend has more mass and thus more inertia, he will have a greater tendency to keep moving and thus will jerk forward more since the bus is decelerating.

7. B. There are many ways to explain this. We can use inertia. As Dexter was stationary before the lift starts to move, his body would want to remain so. As the lift starts to move down, his body wants to remain at the same position or height. Thus, he will be 'lighter' for a moment as his body is taking a little more time to start to move with the lift.

8. A. The frequency is 700/14. The speed is (3.5km x 1000)/350. Use $V = f\lambda$ to solve.

9. A. You can draw a graph with length as the y-axis and then temperature as the x-axis. Plot the two points given, find gradient and then use the gradient to find the unknown. This method can be a little tedious, but you will get correct almost 100% of the time. If you use the unitary method or formula, there is chance for error as you may be unsure of whether to add or minus the -15 deg C.

10. False. Water boils at a higher boiling point in pressure cookers as the pressure is higher. This is how pressure cookers work. The water takes a longer time to boil so it stays as liquid and passes the heat to the rice faster and so the rice is cooked faster.

11. False. Use $R = \frac{\rho l}{A}$ If the area is twice then statement would be correct as the 2x length and 2xA will cancel out each other. But the diameter is twice and that makes wire A 4 times larger in area. Thus, the Wire A would have half the resistance.

12. Yes. The questions asked if he is able to use his appliance and the answer is yes. This is because the live wire is still connected to the live terminal and so current can still flow. The metal casing is live and that means Yuyang will likely get a shock if he teaches it. However, the appliance can still work.

How did you score?

If you scored between 50-70%, it means you do not have a good understanding of the fundamentals BUT you have will be learning or have learned quite a lot from this simple exercise. Good for you. By doing the questions and understanding the answers, you have progressed in physics with greater knowledge of the applications. However, you have a long way to go, I would recommend that you finish all your TYS questions and start doing more school paper questions.

If you scored between 70-90%, it means you have a decent understanding of the fundamentals and you just need to find more challenging questions. Keep grinding and you will work your way to an A grading. Be sure to work more on your paper 2 questions such as those that require you to answer with the right keywords as well as the data-based ones.

If you scored a 100%, then good for you. You have good mastery of the fundamentals. Be sure of to work more on your paper 2 questions such as those that require you to answer with the right keywords as well as the data-based ones.

Keep working hard and have fun while learning! We have more questions like these every week during our lessons.