Acceleration Worksheet

Don't forget to solve all physics problems according to the following four steps. Drawing a simple sketch of the problem may help as well.

Knowns **U**nknown **E**quation **S**olve

Acceleration Problems

1. A biker begins to move from a speed of 0 m/s to a final speed of 20 m/s in 10 seconds. What is the biker's acceleration?

2. The fastest land animal, the cheetah, can accelerate from 0 m/s to 33 m/s in 3 seconds. What is the cheetah's acceleration?

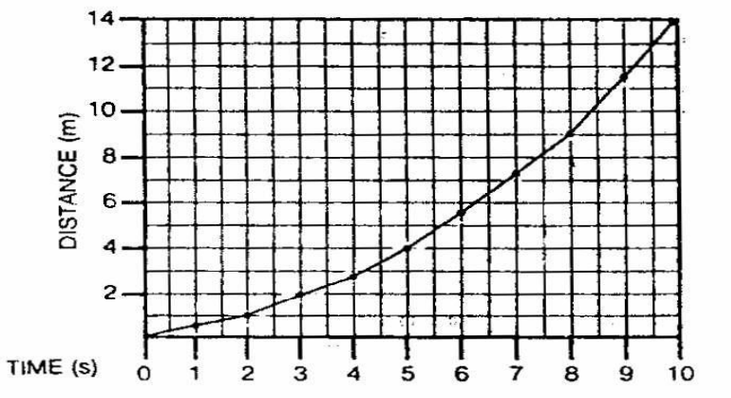
3. While traveling along the highway, a driver applies the brakes and slows from -27 m/s to -15 m/s with an acceleration of +2 m/s^2. How much time was the driver applying the brakes?

4. A dragster is travelling east when the parachute opens and slows the dragster for 4.5 seconds at a rate of 10 m/s^2 west. What was the dragster's change in velocity due to the parachute?

5. Marshall is driving on Macland Rd at 18 m/s and decides to pass the car in front of him which is also moving at 18 m/s. He accelerates at a rate of 2 m/s^2 for 3 seconds. What is the fastest speed Marshall reaches as he passes the other car? Will he get a speeding ticket if does not slow down after he makes the pass? The speed limit is 45 mi/h.

Conceptual Questions #6-27 – answer all questions completely and on your own paper

The graph below shows the motion of a toy car. Use the graph to answer #6 & 7. When reading the graph, distances should be recorded to the nearest 0.1 meter and time to the nearest 0.1 second.



6. What does the slope of the graph tell you about the motion of the car? What about the graph shows that the car is accelerating?

7. What was the car's average speed during (a) the first second (0-1s)? (b) the fifth second (4-5s)? (c) the tenth second (9-10s)? Do these results support response to #6?

8. Can an automobile with a velocity toward the north accelerate toward the south? Explain with an example.

9. Can an object reverse its direction of travel while maintaining a constant acceleration? If so, give an example. If not, explain why.

10. You are driving north on a highway. Then without changing speed, you round a curve and drive east. (a) Does your velocity change? (b) Do you accelerate? Explain.

11. Starting from rest, one car accelerates to a speed of 50 km/h, and another car accelerates to a speed of 60 km/h. Can you say which car underwent the greater acceleration? Why or why not?

12. Cite an example of something that undergoes acceleration while moving at a constant speed. Can you also give an example of something that accelerates while traveling at constant velocity? Explain

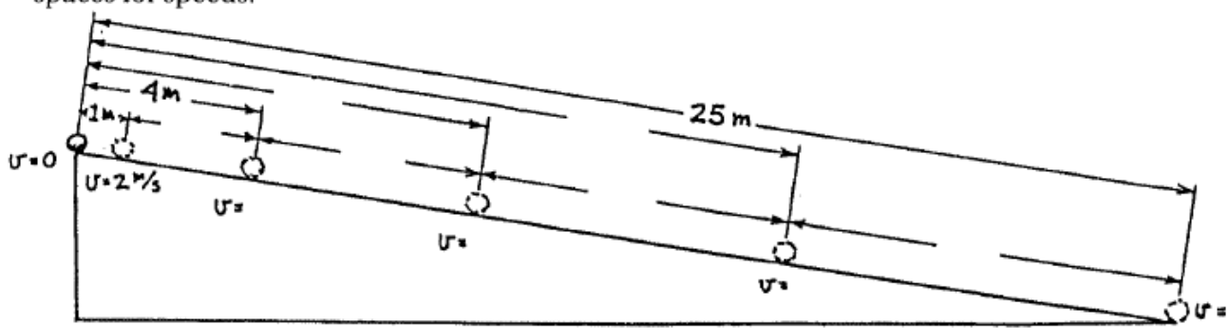
13. (a) Can an object be moving when its acceleration is zero? If so, give an example. (b) Can an object be accelerating when its speed is zero? If so give an example.

14. What is the acceleration of a car that moves at a steady velocity of 100 km/h for 100 seconds? Explain your answer.

15. On which of these hills does the ball roll down with increasing speed and decreasing acceleration along the path?

Conceptual Questions #6-27 – answer all questions completely and on your own paper

11. An object starting from rest gains a speed $v = at$ when it undergoes uniform acceleration. The distance it covers is $d = 1/2\ at^2$. Uniform acceleration occurs for a ball rolling down an inclined plane. The plane below is tilted so a ball picks up a speed of 2 m/s each second; then its acceleration $a = 2\ m/s^2$. The positions of the ball are shown for 1-second intervals. Complete the six blank spaces for distance covered, and the four blank spaces for speeds.



a. Do you see that the total distance from the starting point increases as the square of the time? If the incline were to continue, predict the ball's distance for the next 3 seconds.

17. What are the conditions for a freely falling object?

18. What is the gain in velocity per second for a freely falling object?

19. The acceleration of free fall is about 10 m/s^2. Why does the seconds unit appear twice?

20. What is the velocity acquired by a freely falling object 5.0 seconds after being dropped from a rest position? What is it after 6.0 seconds?

21. What is the displacement of a freely falling object 5.00 seconds after being dropped from a rest position? What is it after 6.00 seconds?

22. If a friend claims that in a standing jump he can remain off the ground for 1.0 second then how high can he jump? For 2.0 seconds? Are either of these claims likely to be true?

23. Suppose that a freely falling object were somehow equipped with a speedometer. By how much would its speed reading increase with each second of fall?

24. Suppose that the same freely falling object were also equipped with an odometer. Would the readings of distance fallen indicate equal or different falling distances for successive seconds?

25. For a freely falling object dropped from rest, what is the acceleration at the end of the 5^{th} second of fall? The 10^{th} second? Defend your answer.

26. When a ball player throws a ball straight up, by how much does the velocity of the ball decrease each second while ascending? By how much does it increase while descending? How much time is required for rising as compared to falling?

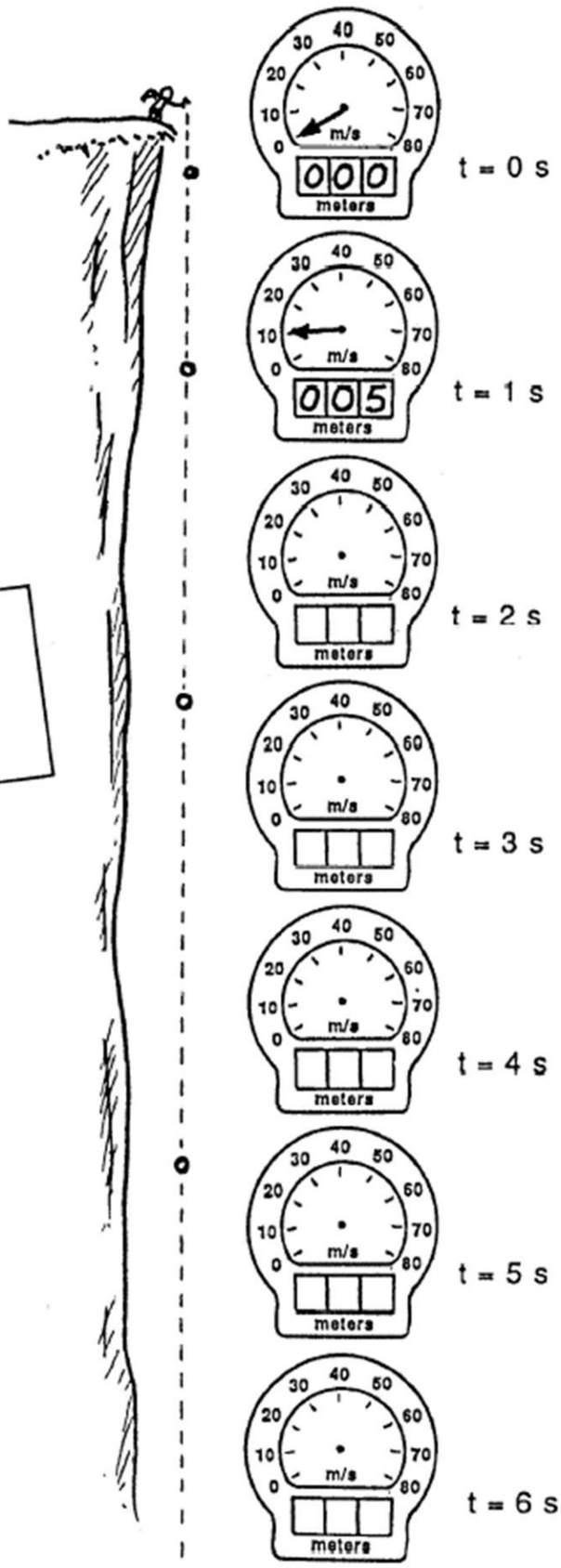
27. Someone standing at the edge of a cliff throws a ball nearly straight up at 30 m/s. How long (time) will it take for the ball to reach the top of its flight? Air resistance is negligible.

Conceptual Questions #6-27 – answer all questions completely and on your own paper

Free Fall

28. A rock dropped from the top of a cliff picks up speed as it falls. Pretend that a speedometer and odometer are attached to the rock to show readings of speed and distance at 1-second intervals. Both speed and distance are zero at time = zero (see sketch). Note that after falling 1 second the speed reading is 10 m/s and the distance fallen is 5 m. The readings for succeeding seconds of fall are not shown and are left for you to complete. So draw the position of the speedometer pointer and write in the correct odometer reading for each time. Use $g = 10\ m/s^2$ and neglect air resistance.

RELATIONSHIPS TO USE
Instantaneous speed of fall from rest: $v = gt$
Distance fallen from rest: $d = \frac{1}{2}gt^2$



a. The speedometer reading increases by the same amount, _____ m/s, each second. This increase in speed per second is called _____.

b. The distance fallen increases as the square of the _____.

c. If it takes 7 seconds to reach the ground, then its speed at impact is _____ m/s, the total distance fallen is _____ m, and its acceleration of fall just before impact is _____ m/s^2.