Name: _____
Hour: ____ Date: _____

Physics: *1-D Motion HW*

Set 1: Average Velocity

1. It takes you 6.8 min to walk with an average velocity of 1.3 m/s to the north from the bus stop to the gym. What is your displacement?

   G(iven):

   U(nknown):

   E(quation):

   S(olve eq. for unknown):

   S(ubstitute w/proper units and round to sig figs):

2. Joseph drives his car on the highway with an average speed of 102 km/h. How long will it take him to drive 192 km?

   G:

   U: S:

   E: S:

3. With reference to Q2, how much time would Joseph save by increasing his average speed to 111 km/h?

4. A car travels 256 km with an average speed of 93 km/h. The car then stops for 16 min. Finally, it travels 185 km with an average speed of 81 km/h.

   a. Find the time it takes to make the trip.

   b. Determine the car's average speed for the total trip.

ANSWERS: 1. 530 m N 2. 1.88 h 3. 0.15 h (9.0 min) 4a. 5.3 h 4b. 83 km/h

Set 2: Average Acceleration

5. A go-cart has an initial velocity of –2.3 m/s before speeding up uniformly. After 2.25 min, the go-cart has a velocity of –8.4 m/s. What is the average acceleration of the go-cart over this time?

G:

U: S:

E: S:

6. At a rate of –1.5 m/s^2, how long will it take a skateboarder with an initial speed of 4.2 m/s to stop?

G:

U: S:

E: S:

7. A truck traveling initially at 5.4 m/s accelerates at 1.85 m/s^2 to reach a speed of 9.8 m/s. What time elapsed?

G:

U: S:

E: S:

8. A remote-controlled racecar has an average acceleration of 0.0285 m/s^2.

a. By how much does its speed change after 1.3 min, assuming uniform acceleration?

G:

U: S:

E: S:

b. If the racecar's initial speed is 0.6 m/s, what will its final speed be?

ANSWERS: 5. –0.045 m/s^2 6. 2.8 s 7. 2.4 s 8a. 2.2 m/s 8b. 2.8 m/s

Set 3: Displacement with Constant Acceleration, Part I

9. A bus accelerates from rest to 7.6 m/s in 12.3 s. Find the distance the bus travels over this time span.

G:

U: S:

E: S:

10. A car is traveling at an initial speed of 14 m/s when the driver applies the brakes. If the car travels an additional 38 m, how long did it take for the car to stop?

G:

U: S:

E: S:

11. A motorcycle enters the interstate from an on-ramp going 20.1 m/s. It accelerates uniformly for 1.10 km in 0.810 min. How fast (in m/s) is the motorcycle moving after this time?

G:

U: S:

E: S:

12. A ball is thrown downward from the top of a building with an unknown speed. After Δt seconds, it has fallen Δx meters and is traveling at a speed of v_f. What was the initial speed of the ball?

G: E:

U: S:

13. A car starts from rest and accelerates uniformly to a speed of W m/s while covering a straight-line distance of (W + B) meters. What time elapsed?

G:

U: S:

E: S:

ANSWERS: 9. 47 m 10. 5.4 s 11. 25.2 m/s

Set 4: Displacement with Constant Acceleration, Part II

14. A pick-up truck with initial speed 3.72 m/s accelerates at 3.15 m/s^2. Find the final speed after 5.33 s.

G:

U: S:

E: S:

15. What distance does the pick-up in Q14 cover in the time elapsed?

G:

U: S:

E: S:

16. A sprinter starts at rest and runs for 3.1 s with an acceleration of 6.0 m/s^2. How far does he go in this time?

G:

U: S:

E: S:

17. A driver of a car going 16.7 m/s applies the brakes, causing an acceleration of –1.7 m/s^2. How long does it take the car to achieve a final speed of 8.3 m/s?

G:

U: S:

E: S:

18. With reference to Q17, how far has the vehicle moved during the braking period?

G:

U: S:

E: S:

ANSWERS: 14. 20.5 m/s 15. 64.5 m 16. 29 m 17. 4.9 s 18. 61 m

Set 5: The "No Time" Equation

19. A bus going +3.5 m/s accelerates at +0.75 m/s^2 for 133 m. What is its speed at the end of the acceleration?

G:

U: S:

E: S:

20. A car accelerates from rest at 2.1 m/s^2. What is the car's speed after it has traveled 45 m?

G:

U: S:

E: S:

21. A plane has a takeoff speed of 34 m/s. What acceleration is needed for it to effectively use a 275 m runway?

G:

U: S:

E: S:

22. A boat accelerates from 8.5 m/s west to 1.8 m/s west at a rate of 2.9 m/s^2 east. How far does it travel?

G:

U: S:

E: S:

23. A truck accelerates at 1.25 m/s^2. How far does it go as it accelerates uniformly from 63 km/h to 84 km/h?

G:

U: S:

E: S:

ANSWERS: 19. 15 m/s 20. 14 m/s 21. 2.1 m/s^2 22. 12 m 23. 95 m

Set 6: Falling Objects

24. A robot drops a camera off a 215 m high cliff on the Moon, where the free-fall acceleration is –1.6 m/s^2. Find the time the camera takes to hit the surface at the bottom of the cliff.

G:

U: S:

E: S:

25. With reference to Q24, find the speed with which the camera hits the surface.

G:

U: S:

E: S:

26. A bucket falls off a shelf 35.0 m above the ground. How fast is the bucket moving when it hits?

G:

U: S:

E: S:

27. A walnut is thrown upward at 15.5 m/s. How long will the walnut take to come back to its starting point?

G:

U: S:

E: S:

28. With reference to Q27, find the height of the walnut above the release point when its velocity is +6.23 m/s.

G:

U: S:

E: S:

ANSWERS: 24. 16 s 25. 26 m/s 26. 26.2 m/s 27. 3.16 s 28. 10.3 m

Set 7: Linear Regression Problems

29. A cart is released with some nonzero initial speed down an incline. Its speed "v_f" at various times "t" after release is given below.

X t (s)	0.25	0.50	0.75	1.00	1.25	1.50
Y v_f (m/s)	0.843	1.051	1.298	1.462	1.734	1.925

a. Find the equation of the linear least squares fit that describes this data. Use "t" and "v_f" in your equation, NOT "X" and "Y" or "a" and "b."

b. For this particular type of motion, it is known that the slope of the velocity-time curve is the object's acceleration. Look at your equation; determine the cart's acceleration. Include the correct unit.

c. Use the equation to estimate the initial speed of the cart. Include the correct unit.

d. Use the equation to estimate the time at which the speed of the cart is 5.634 m/s. Include a unit.

30. A ball is released from rest. Its position "y" at various times "t" after release is given below.

t (s)	0.25	0.50	0.75	1.00	1.25	1.50
X t^2 (s^2)						
Y y (m)	0.303	1.234	2.768	4.892	7.651	11.105

a. For each data point, "t" is given above. Calculate t^2 for each point and put those values in the table.

b. Now find the equation of the linear regression line that describes this data. Use "t^2" and "y" in your equation, NOT "X" and "Y" or "a" and "b."

c. For this particular type of motion, it is known that the acceleration of the ball is equal to twice the slope of the regression line. Look at your equation; determine the acceleration of the ball.

d. Using your linear least squares fit, estimate the position of the ball at t = 3.20 s.

ANSWERS: 29b. 0.8712 m/s^2 29c. 0.6232 m/s 29d. 5.75 s 30c. 9.852 m/s^2 30d. 50.43 m

31. The volume "V" of a confined sample of gas is measured at various temperatures "T," as shown below.

X T (°C)	–40	–10	0	20	30	40
Y V (cm^3)	22.01	24.84	25.55	27.73	28.51	29.68

a. Find the equation of the linear regression line that describes this data. Use proper variables.

b. Use the equation to estimate the volume of the sample when the temperature is 125°C.

c. Use the equation to estimate the temperature at which the volume of the sample is zero cm^3.

d. You learned about gases in chemistry. Your answer to Q31c should be close to a value of temperature that you recognize. What is that value of temperature, and what does it represent?

32. A student attaches a ball to a string and whirls it above her head in a horizontal circle. The radius "R" of the motion and the speed "v" of the ball are given below for several different experimental trials.

X R (m)	0.20	0.40	0.60	0.80	1.00	1.20
v (m/s)	0.814	1.141	1.407	1.588	1.824	2.012
Y v^2 (m^2/s^2)						

a. For each data point, "v" is given above. Calculate v^2 for each data point and fill in the table.

b. Now, find the equation of the linear least squares fit that describes this data. Use proper variables.

c. For this particular type of motion, it is known that the acceleration of the ball is the slope of the regression line. Look at your equation and determine the acceleration of the ball.

d. Use the equation to estimate the circle's radius when the speed of the ball is 2.756 m/s.

e. Use the equation to estimate the speed of the ball when the circle's radius is 0.13 m.

ANSWERS: 31b. 37.66 cm^3 32c. 3.363 m/s^2 32d. 2.27 m 32e. 0.624 m/s