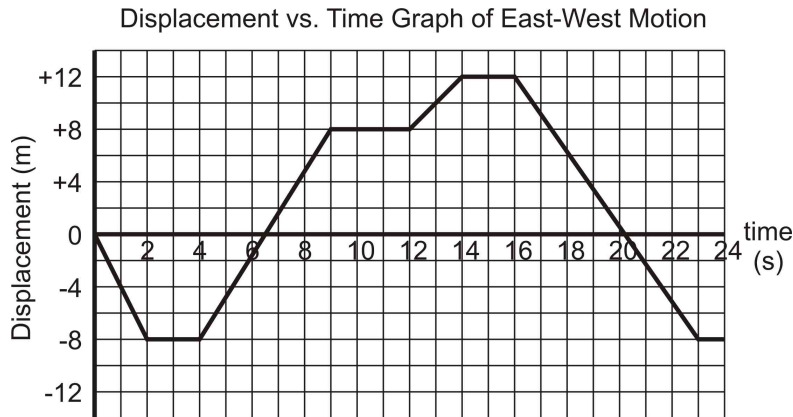


Physics 112 Review Sheets for Exam

1. What is instantaneous speed?
2. What is the difference between speed and velocity?
3. Of what is the acceleration the rate of change?
4. What is the change of speed each second for a freely falling body?
5. A bullet of mass 0.050 kg leaves the muzzle of a 4.0 kg gun with a velocity of 400 m/s. What is the recoil velocity of the gun? [-5.0 m/s]
6. How can an object accelerate while travelling at constant speed?
7. How long must a force of 50 N act on a 400 kg wagon to change its speed from 10.0 m/s to 12.0 m/s? [16 s]
8. Of what is mass a measure?
9. State Newton's second law. What is the equation for Newton's second law?
10. What is the acceleration of a rock thrown vertically upward when it reaches its highest point?
11. A pendulum has a bob of mass 1.0 kg. At either of its highest points of its swing, the bob is 0.10 m higher than at the lowest part of its swing. What is the speed of the bob as it passes the lowest point of its swing? [1.4 m/s]
12. How are vectors placed in order to add them?
13. If you do 200 J of work to lift a box from the floor, what is the potential energy of the box with respect to the floor?
14. An 8.0 kg object falls to the floor from a shelf 2.5 m high. With what speed does it hit the floor? [7.0 m/s]
15. Martin watches as a package is dropped from a rescue helicopter and times its descent. If it took 5.54 s to reach the ground, what was the helicopter's altitude? [150 m]
16. A biker travels at 30 km/h West for 0.70 h, then travels 50 km/h North for 0.40 h. What was her average velocity and her average speed? [26 km/h 314°, 37 km/h]
17. A student in orienteering class travels 70 m 090° and then travels an additional 110 m 180°. The whole trip took 40.0 s.
 - (a) Draw a neat vector diagram showing the resultant displacement of the student.
 - (b) What is the resultant displacement? [130 m 148°]
 - (c) What is the student's average velocity for the whole trip? [3.3 m/s 148°]
 - (d) What is the student's average speed for the whole trip? [4.5 m/s]
18. What is the displacement of a car that has a Westward velocity of 30 m/s and an acceleration of 2.0 m/s² in an Eastward direction for 10 s? [200 m W]
19. The work done when a force of 20 N slides a box weighing 600 N a distance of 5.0 m is: [100 J]
20. A woman weighing 700 N climbs a flight of stairs that is 2.0 m high vertically. What is the amount of work done in climbing the stairs? [1400 J]
21. The power used when a boy (m=50 kg) climbs a flight of stairs 10 m high in 30 s is: [163 W]
22. What is the kinetic energy of a bullet of mass 5.00 g if its speed is 200 m/s? [100 J]
23. A 20 kg box placed on an inclined plane is pushed up the plane a distance of 2.0 m to a height of 1.0 m with a force of 160 N. What is the efficiency of this plane? [61%]
24. A 30 kg object placed on a 30° incline is being pushed up the plane with a force of 200 N. The friction opposing the motion is 20 N and the distance the object moves is 2.00 m.
 - (a) What is the work done? [400 J]
 - (b) How much energy is removed by friction? [40 J]
 - (c) What is the efficiency of this process? [90 %]
25. What speed will a 20.0 kg cart have as it rounds the top of a frictionless vertical loop? The loop is positioned at ground level and has a diameter of 2.0 m. The cart started 3.0 m above the ground and with a speed of 4.0 m/s. [6.0 m/s]
26. A radio controlled car travels in a straight line from point A to point B. It starts from rest and accelerates to 5.00 m/s in 2.0 s. It then continues at this speed for the next 100 s. If the car slows down to a stop at the rate of 2.0 m/s² how far is it between points A and B? [511 m]
27. Kelly throws a baseball straight down from the roof of a tall building and it takes 2.6 s to reach the ground. What speed did the ball have when it left Kelly's hand if the building was 50 m tall? [-6.5 m/s]

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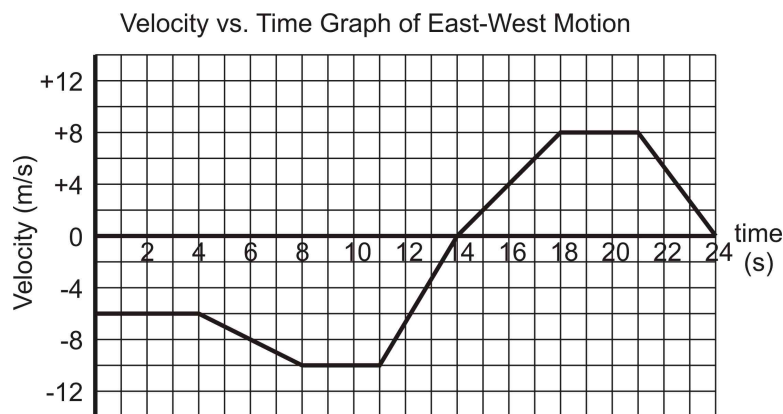
28. You wish to paddle your canoe at 3.0 m/s **straight** across a river that is flowing at 5.0 m/s. At what velocity do you need to paddle your canoe to do this? [5.8 m/s 31° upstream]
29. In the Feb. 8th, 2000 Glob and Mail, the Inuktitut word **saqiyuq** was defined as “a wind that whips across the land or ice, changing directions, but maintaining its velocity.” As a student in physics, what would you say is wrong with this definition?
30. What is the sum of the following vectors? 58 m/s 300° and 70 m/s 210° [91 m/s 250°]
31. Answer the following questions about the $\vec{d} - t$ graph.



- (a) What is the object's speed at 6 s? (a) _____
- (b) When is the object travelling the fastest? (b) _____
- (c) What is its velocity at 13 s? (c) _____
- (d) When did it return to the starting point? (d) _____
- (e) What is its final displacement? (e) _____
- (f) When did it first start to travel East? (f) _____
- (g) What is its average speed for the whole trip? (g) _____
- (h) What is its average velocity? (h) _____
- (i) What is the object doing at 15 s? (i) _____
32. (a) What do we know about the motion of an object if the ratio d/t is constant?
 (b) What do we know about the motion if the ratio d/t^2 is constant?
33. What are the components of the force vector 280 N 172°? [277 N South and 39.0 N East]
34. Two rocks in space collide. One rock has a mass of 2.67 kg and travels at an initial speed of 170 m/s toward Jupiter; the other rock has a mass of 5.83 kg. After the collision, the rocks are both moving toward Jupiter with a speed of 185 m/s for the less massive rock and 183 m/s for the more massive rock. What is the initial velocity of the more massive rock? [+1.90 m/s]
35. A 59.0 g tennis ball is thrown upward and is hit just as it comes to rest at the top of its motion. It is in contact with the racket for 5.1 ms. The average force exerted on the ball by the racket is 324 N horizontally.
- (a) What is the impulse on the ball? [+1.7 Ns]
 (b) What is the velocity of the ball as it leaves the racket? [+29 m/s]

Physics 112 Review Sheets for Exam

36. Answer the following questions about the $\vec{v} - t$ graph



- (a) What is the object's speed at 6 s? (a) _____
- (b) When is the object travelling the fastest? (b) _____
- (c) What is its velocity at 13 s? (c) _____
- (d) When did it return to the starting point? (d) _____
- (e) What is its final displacement? (e) _____
- (f) When did it first start to travel East? (f) _____
- (g) What is its average speed for the whole trip? (g) _____
- (h) What is its average velocity? (h) _____
- (i) What is the object doing at 15 s? (i) _____
- (j) When is the object slowing down? (j) _____
- (k) When is the object stopped? (k) _____

37. What is destructive interference? Is it possible for one wave to cancel another so that the resultant amplitude is zero?

- 38. (a) What is the period of a wave having a frequency of 450 Hz? [2.22×10^{-3} s]
- (b) What is the frequency of a wave that has a period of 0.45 s? [2.2 Hz]

39. What is the period of a sound wave of wavelength 1.2 m when the air temperature is 15.0 °C? [3.5×10^{-3} s]

40. Compare and contrast transverse and longitudinal waves.

41. A note of frequency 375 Hz is sounded in air at 5.0 °C. What is the wavelength? [0.87 m]

42. What types of waves experience the Doppler-Fizeau effect?

43. During a foggy day when the air temperature was 12.0 °C, you hear the echo from your boat's fog horn 4.5 s after it was sounded. How far away is the cliff or other large object? [761 m]

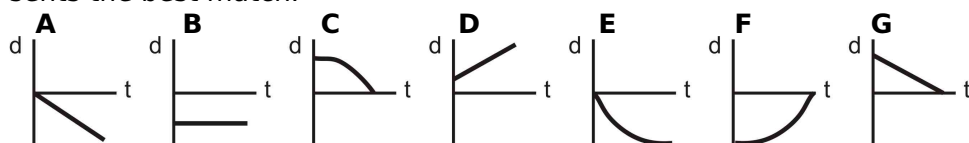
44. A tuning fork of unknown frequency makes 4.0 beats per second when sounded with a standard tuning fork of frequency 256 Hz.

- (a) What are the possible values of the unknown frequency? [252 Hz or 260 Hz]
- (b) A piece of gum put on one prong of the fork of unknown frequency reduces the number of beats. What must the original frequency of the unknown fork have been? [260 Hz]

Physics 112 Review Sheets for Exam

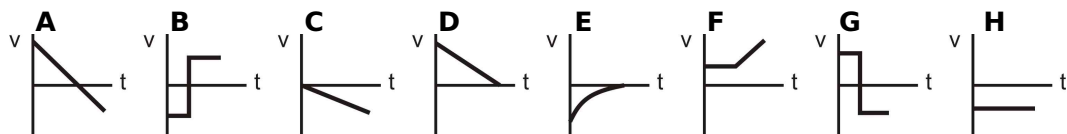
45. Calculate the speed of light in the gem garnet. The refractive index for garnet is 1.88.
[1.60 × 10⁸ m/s]
46. When light goes from a certain substance into water (n=1.33), the critical angle is 65.0°. What is the index of refraction of the substance? [1.47]
47. A beam of light is directed so as to pass from water (n=1.33) into chloroform (n=1.51). The angle of refraction is found to be 36.0°. What is the angle of incidence? [41.9°]
48. List five wave energies that belong to the electromagnetic spectrum and give the speed of each.
49. A beam of light enters a piece of glass at an angle of incidence of 39.0° and refracts with an angle of refraction of 25.0°
- (a) What is the index of refraction of the glass? [1.49]
 (b) What is the speed of light in the glass? [2.01 × 10⁸ m/s]
 (c) What is the critical angle for the glass into air? [42.2°]
50. List the colours of the light spectrum in order from longest wavelength to shortest.
51. Explain the “colours” white and black.
52. How do we see an object?
53. Draw ray diagrams showing reflection, refraction, critical angle and total internal reflection.
54. What is meant by diffraction and why do radio waves diffract around buildings while visible light waves do not?
55. What must the angle of incidence be for a ray of light to pass straight through the boundary between two media?
56. Red light of wavelength 668 nm falls on two narrow slits 0.0190 mm apart. What is the distance to the 1st order maximum if the screen is 0.600 m from the slits? [0.0211 m]
57. Monochromatic orange light of wavelength 605 nm falls on a single slit. The slit is located 85 cm from the screen and the centre of the first dark band is 5.4 mm from the central bright band. How wide is the slit? [9.5 × 10⁻⁵ m]
58. A marble is dropped from a height of 600 m. How long will it take the marble to reach the ground? [11.1 s]
59. What is the length of the waves produced by a tuning fork of frequency 4096 Hz? The air temperature is -6 °C. [8 cm]
60. What is the air temperature if the speed of sound is 346 m/s [24 °C]

61. Several d vs. t graphs are shown. For each motion described, choose the graph that represents the best match.



- I. A car starting East of the origin returns to the origin at a constant velocity.
 II. A car starting East of the origin travels East at constant velocity.
 III. A car stopped West of the origin.
 IV. A car starting at the origin slows down travelling West.
 V. A car starting West of the origin speeds up travelling East.

62. Several v vs. t graphs are shown. For each motion described, choose the graph that represents the best match.



- I. A ball is dropped from the top of a building.
 II. A ball moving left hits a wall and bounces back.
 III. A runner travels West at a constant velocity.
 IV. A car travelling East slows to a stop.
 V. A runner travelling East at a constant pace sees the finish line and sprints to the finish.
 VI. A ball tossed into the air.

Physics 112 Review Sheets for Exam

63. A horizontal force of 85 N is required to pull a sled at constant speed over snow in order to overcome the force of friction. The sled has a mass of 52 kg. What is the coefficient of friction between the sled and the snow? [0.167]
64. (a) Find the weight of a 4.0 kg mass on the Earth. [39.2 N]
(b) Find the acceleration due to gravity on the moon given that the above 4.0 kg object weighs 6.6 N on the moon. [1.65 N/kg]
65. Cliff pushes a grocery cart with a force of 450 N at an angle of 30.0° to the horizontal. If the mass of the cart is 42 kg
(a) calculate the force of friction if the coefficient is 0.60. [382 N]
(b) what is the acceleration of the cart? [0.18 m/s²]
66. (a) What is the acceleration of a 68.0 kg crate that is pushed across the floor by a 425 N force if the coefficient of friction is 0.500? [1.35 m/s²]
(b) What force would be required to push it at a constant velocity? [333.5 N]
67. A box with a mass of 75.0 kg rests on a horizontal surface where the coefficient of sliding friction is 0.210. A force of 285 N East is applied for a period of 10.0 seconds. Find
(a) the normal force. [735.8 N]
(b) the frictional force. [154.5 N]
(c) the net force. [130.5 N]
(d) the acceleration. [1.74 m/s²]
(e) the displacement after 10.0 seconds. [87.0 m]
68. Dwight drops a 1.5 kg book from a height of 1.75 m. What is the impulse the floor exerts on the book when it hits? [8.78 kg·m/s]
69. A 125 g ball is thrown with a force of 85.0 N that acts over a distance of 78.0 cm. The ball's velocity just before it is caught is 9.84 m/s.
(a) What is the work done on the ball? [66.3 J]
(b) What is the KE of the ball just before it is caught? [6.05 J]
70. A spring with a constant of 450 N/m hangs vertically. Martin attaches a 2.2 kg block to it and allow the mass to fall. What is the max distance it will fall before it begins to move upwards? [0.096 m]
71. How much energy is required to operate the following devices for 30 min.
(a) 150 W light. [2.70 × 10⁵ J]
(b) 900 W hair dryer. [1.62 × 10⁶ J]
(c) 2000 W heater. [3.6 × 10⁶ J]
(d) 2.5 × 10⁶ W motor. [4.5 × 10⁹ J]