Chapter 1: MEASUREMENT

1. The SI standard of time is based on:

A. the daily rotation of the earth

B. the frequency of light emitted by Kr86

C. the yearly revolution of the earth about the sun

D. a precision pendulum clock

E. none of these

Ans: E

2. A nanosecond is:

A. 109 s

B. 10−9 s

C. 10−10 s

D. 10−10 s

E. 10−12

Ans: B

3. The SI standard of length is based on:

A. the distance from the north pole to the equator along a meridian passing through Paris B. wavelength of light emitted by Hg198

C. wavelength of light emitted by Kr86

D. a precision meter stick in Paris

E. the speed of light

Ans: E

4. In 1866, the U. S. Congress defined the U. S. yard as exactly 3600/3937 international meter. This was done primarily because:

A. length can be measured more accurately in meters than in yards

B. the meter is more stable than the yard

C. this definition relates the common U. S. length units to a more widely used system D. there are more wavelengths in a yard than in a meter

E. the members of this Congress were exceptionally intelligent

Ans: C

5. Which of the following is closest to a yard in length?

A. 0.01 m

B. 0.1 m

C. 1 m

D. 100 m

E. 1000 m

Ans: C

Chapter 1: MEASUREMENT 1

6. There is no SI base unit for area because:

A. an area has no thickness; hence no physical standard can be built B. we live in a three (not a two) dimensional world

C. it is impossible to express square feet in terms of meters D. area can be expressed in terms of square meters

E. area is not an important physical quantity

Ans: D

7. The SI base unit for mass is:

A. gram

B. pound

C. kilogram

D. ounce

E. kilopound

Ans: C

8. A gram is:

A. 10−6 kg

B. 10−3 kg

C. 1 kg

D. 103 kg

E. 106 kg

Ans: B

9. Which of the following weighs about a pound?

A. 0.05 kg

B. 0.5 kg

C. 5 kg

D. 50 kg

E. 500 kg

Ans: D

10. (5.0 × 104) × (3.0 × 106) =

A. 1.5 × 109

B. 1.5 × 1010

C. 1.5 × 1011

D. 1.5 × 1012

E. 1.5 × 1013

Ans: C

11. (5.0 × 104) × (3.0 × 10−6) =

A. 1.5 × 10−3

B. 1.5 × 10−1

C. 1.5 × 101

D. 1.5 × 103

E. 1.5 × 105

Ans: B

2 Chapter 1: MEASUREMENT

12. 5.0 × 105 + 3.0 × 106 =

A. 8.0 × 105

B. 8.0 × 106

C. 5.3 × 105

D. 3.5 × 105

E. 3.5 × 106

Ans: E

13. (7.0 × 106)/(2.0 × 10−6) =

A. 3.5 × 10−12

B. 3.5 × 10−6

C. 3.5

D. 3.5 × 106

E. 3.5 × 1012

Ans: E

14. The number of significant figures in 0.00150 is:

A. 2

B. 3

C. 4

D. 5

E. 6

Ans: B

15. The number of significant figures in 15.0 is:

A. 1

B. 2

C. 3

D. 4

E. 5

Ans: C

16. 3.2 × 2.7 =

A. 9

B. 8

C. 8.6

D. 8.64

E. 8.640

Ans: C

Chapter 1: MEASUREMENT 3

17. 1.513 + 27.3 =

A. 29

B. 28.8

C. 28.9

D. 28.81

E. 28.813

( )Ans: B

18. 1 mi is equivalent to 1609 m so 55 mph is:

A. 15 m/s

B. 25 m/s

C. 66 m/s

D. 88 m/s

E. 1500 m/s

Ans: B

19. A sphere with a radius of 1.7 cm has a volume of:

A. 2.1 × 10−5 m3

B. 9.1 × 10−4 m3

C. 3.6 × 10−3 m3

D. 0.11 m3

E. 21 m3

Ans: A

20. A sphere with a radius of 1.7 cm has a surface area of:

A. 2.1 × 10−5 m2

B. 9.1 × 10−4 m2

C. 3.6 × 10−3 m2

D. 0.11 m2

E. 36 m2

Ans: C

21. A right circular cylinder with a radius of 2.3 cm and a height of 1.4 m has a volume of: A. 0.20 m3

B. 0.14 m3

C. 9.3 × 10−3 m3

D. 2.3 × 10−3 m3

E. 7.4 × 10−4 m3

Ans: D

22. A right circular cylinder with a radius of 2.3 cm and a height of 1.4 cm has a total surface area of:

A. 1.7 × 10−3 m2

B. 3.2 × 10−3 m2

C. 2.0 × 10−3 m3

D. 5.3 × 10−3 m2

E. 7.4 × 10−3 m2

Ans: D

4 Chapter 1: MEASUREMENT

23. A cubic box with an edge of exactly 1 cm has a volume of:

A. 10−9 m3

B. 10−6 m3

C. 10−3 m3

D. 103 m3

E. 106 m3

Ans: B

24. A square with an edge of exactly 1 cm has an area of:

A. 10−6 m2

B. 10−4 m2

C. 102 m2

D. 104 m2

E. 106 m2

Ans: B

25. 1 m is equivalent to 3.281 ft. A cube with an edge of 1.5 ft has a volume of: A. 1.2 × 102 m3

B. 9.6 × 10−2 m3

C. 10.5 m3

D. 9.5 × 10−2 m3

E. 0.21 m3

Ans: B

26. During a short interval of time the speed v in m/s of an automobile is given by v = at2 + bt3, where the time t is in seconds. The units of a and b are respectively:

A. m · s2; m · s4

B. s3/m; s4/m

C. m/s2; m/s3

D. m/s3; m/s4

E. m/s4; m/s5

Ans: D

27. Suppose A = BC, where A has the dimension L/M and C has the dimension L/T. Then B has the dimension:

A. T/M

B. L2/TM

C. TM/L2

D. L2T/M

E. M/L2T

Ans: A

Chapter 1: MEASUREMENT 5

28. Suppose A = BnCm, where A has dimensions LT, B has dimensions L2T−1, and C has dimensions LT2. Then the exponents n and m have the values:

A. 2/3; 1/3

B. 2; 3

C. 4/5; −1/5

D. 1/5; 3/5

E. 1/2; 1/2

Ans: D

6 Chapter 1: MEASUREMENT

Chapter 2: MOTION ALONG A STRAIGHT LINE

1. A particle moves along the x axis from xi to xf . Of the following values of the initial and final coordinates, which results in the displacement with the largest magnitude?

A. xi = 4 m, xf = 6m

B. xi = −4 m, xf = −8 m

C. xi = −4 m, xf = 2m

D. xi = 4 m, xf = −2 m

E. xi = −4 m, xf = 4m

ans: E

2. A particle moves along the x axis from xi to xf . Of the following values of the initial and final coordinates, which results in a negative displacement?

A. xi = 4 m, xf = 6m

B. xi = −4 m, xf = −8 m

C. xi = −4 m, xf = 2m

D. xi = −4 m, xf = −2 m

E. xi = −4 m, xf = 4m

ans: B

3. The average speed of a moving object during a given interval of time is always: A. the magnitude of its average velocity over the interval

B. the distance covered during the time interval divided by the time interval C. one-half its speed at the end of the interval

D. its acceleration multiplied by the time interval

E. one-half its acceleration multiplied by the time interval.

ans: B

4. Two automobiles are 150 kilometers apart and traveling toward each other. One automobile is moving at 60 km/h and the other is moving at 40 km/h mph. In how many hours will they meet?

A. 2.5

B. 2.0

C. 1.75

D. 1.5

E. 1.25

ans: D

5. A car travels 40 kilometers at an average speed of 80 km/h and then travels 40 kilometers at an average speed of 40 km/h. The average speed of the car for this 80-km trip is: A. 40 km/h

B. 45 km/h

C. 48 km/h

D. 53 km/h

E. 80 km/h

ans: D

Chapter 2: MOTION ALONG A STRAIGHT LINE 7

6. A car starts from Hither, goes 50 km in a straight line to Yon, immediately turns around, and returns to Hither. The time for this round trip is 2 hours. The magnitude of the average velocity of the car for this round trip is:

A. 0

B. 50 km/hr

C. 100 km/hr

D. 200 km/hr

E. cannot be calculated without knowing the acceleration

ans: A

7. A car starts from Hither, goes 50 km in a straight line to Yon, immediately turns around, and returns to Hither. The time for this round trip is 2 hours. The average speed of the car for this round trip is:

A. 0

B. 50 km/h

C. 100 km/h

D. 200 km/h

E. cannot be calculated without knowing the acceleration

ans: B

8. The coordinate of a particle in meters is given by x(t) = 16t − 3.0t3, where the time t is in seconds. The particle is momentarily at rest at t =

A. 0.75 s

B. 1.3 s

C. 5.3 s

D. 7.3 s

E. 9.3 s

ans: B

9. A drag racing car starts from rest at t = 0 and moves along a straight line with velocity given by v = bt2, where b is a constant. The expression for the distance traveled by this car from its position at t = 0 is:

A. bt3

B. bt3/3

C. 4bt2

D. 3bt2

E. bt3/2

ans: B

10. A ball rolls up a slope. At the end of three seconds its velocity is 20 cm/s; at the end of eight seconds its velocity is 0. What is the average acceleration from the third to the eighth second? A. 2.5 cm/s2

B. 4.0 cm/s2

C. 5.0 cm/s2

D. 6.0 cm/s2

E. 6.67 cm/s2

ans: B

8 Chapter 2: MOTION ALONG A STRAIGHT LINE

11. The coordinate of an object is given as a function of time by x = 7t − 3t2, where x is in meters and t is in seconds. Its average velocity over the interval from t = 0 to t = 4 s is: A. 5 m/s

B. −5 m/s

C. 11 m/s

D. −11 m/s

E. −14.5 m/s

ans: B

12. The velocity of an object is given as a function of time by v = 4t − 3t2, where v is in m/s and t is in seconds. Its average velocity over the interval from t = 0 to t = 2 s:

A. is 0

B. is −2 m/s

C. is 2 m/s

D. is −4 m/s

E. cannot be calculated unless the initial position is given

ans: A

13. The coordinate of an object is given as a function of time by x = 4t2 −3t3, where x is in meters and t is in seconds. Its average acceleration over the interval from t = 0 to t = 2 s is: A. −4 m/s2

B. 4 m/s2

C. −10 m/s2

D. 10 m/s2

E. −13 m/s2

ans: C

14. Each of four particles move along an x axis. Their coordinates (in meters) as functions of time (in seconds) are given by

particle 1: x(t)=3.5 − 2.7t3

particle 2: x(t)=3.5+2.7t3

particle 3: x(t)=3.5+2.7t2

particle 4: x(t)=3.5 − 3.4t − 2.7t2

Which of these particles have constant acceleration?

A. All four

B. Only 1 and 2

C. Only 2 and 3

D. Only 3 and 4

E. None of them

ans: D

Chapter 2: MOTION ALONG A STRAIGHT LINE 9

15. Each of four particles move along an x axis. Their coordinates (in meters) as functions of time (in seconds) are given by

particle 1: x(t)=3.5 − 2.7t3

particle 2: x(t)=3.5+2.7t3

particle 3: x(t)=3.5+2.7t2

particle 4: x(t)=3.5 − 3.4t − 2.7t2

Which of these particles is speeding up for t > 0?

A. All four

B. Only 1

C. Only 2 and 3

D. Only 2, 3, and 4

E. None of them

ans: A

16. An object starts from rest at the origin and moves along the x axis with a constant acceleration of 4 m/s2. Its average velocity as it goes from x = 2 m to x = 8 m is:

A. 1 m/s

B. 2 m/s

C. 3 m/s

D. 5 m/s

E. 6 m/s

ans: E

17. Of the following situations, which one is impossible?

A. A body having velocity east and acceleration east

B. A body having velocity east and acceleration west

C. A body having zero velocity and non-zero acceleration

D. A body having constant acceleration and variable velocity

E. A body having constant velocity and variable acceleration

ans: E

18. Throughout a time interval, while the speed of a particle increases as it moves along the x axis, its velocity and acceleration might be:

A. positive and negative, respectively

B. negative and positive, respectively

C. negative and negative, respectively

D. negative and zero, respectively

E. positive and zero, respectively

ans: C

19. A particle moves on the x axis. When its acceleration is positive and increasing: A. its velocity must be positive

B. its velocity must be negative

C. it must be slowing down

D. it must be speeding up

E. none of the above must be true

ans: E

10 Chapter 2: MOTION ALONG A STRAIGHT LINE

20. The position y of a particle moving along the y axis depends on the time t according to the equation y = at − bt2. The dimensions of the quantities a and b are respectively: A. L2/T, L3/T2

B. L/T2, L2/T

C. L/T, L/T2

D. L3/T, T2/L

E. none of these

ans: C

21. A particle moves along the x axis according to the equation x = 6t2, where x is in meters and t is in seconds. Therefore:

A. the acceleration of the particle is 6 m/s2

B. t cannot be negative

C. the particle follows a parabolic path

D. each second the velocity of the particle changes by 9.8 m/s

E. none of the above

ans: E

22. Over a short interval near time t = 0 the coordinate of an automobile in meters is given by x(t) = 27t − 4.0t3, where t is in seconds. At the end of 1.0 s the acceleration of the auto is: A. 27 m/s2

B. 4.0 m/s2

C. −4.0 m/s2

D. −12 m/s2

E. −24 m/s2

ans: E

23. Over a short interval, starting at time t = 0, the coordinate of an automobile in meters is given by x(t) = 27t − 4.0t3, where t is in seconds. The magnitudes of the initial (at t = 0) velocity and acceleration of the auto respectively are:

A. 0; 12 m/s2

B. 0; 24 m/s2

C. 27 m/s; 0

D. 27 m/s; 12 m/s2

E. 27 m/s; 24 m/s2

ans: C

24. At time t = 0 a car has a velocity of 16 m/s. It slows down with an acceleration given by −0.50t, in m/s2 for t in seconds. It stops at t =

A. 64 s

B. 32 s

C. 16 s

D. 8.0 s

E. 4.0 s

ans: D

Chapter 2: MOTION ALONG A STRAIGHT LINE 11

25. At time t = 0 a car has a velocity of 16 m/s. It slows down with an acceleration given by −0.50t, in m/s2 for t in seconds. At the end of 4.0 s it has traveled:

A. 0

B. 12 m

C. 14 m

D. 25 m

E. 59 m

ans: E

26. At time t = 0 a car has a velocity of 16 m/s. It slows down with an acceleration given by −0.50t, in m/s2 for t in seconds. By the time it stops it has traveled:

A. 15 m

B. 31 m

C. 62 m

D. 85 m

E. 100 m

ans: D

27. Starting at time t = 0, an object moves along a straight line with velocity in m/s given by v(t) = 98 − 2t2, where t is in seconds. When it momentarily stops its acceleration is: A. 0

B. −4.0 m/s2

C. −9.8 m/s2

D. −28 m/s2

E. 49 m/s2

ans: D

28. Starting at time t = 0, an object moves along a straight line. Its coordinate in meters is given by x(t) = 75t − 1.0t3, where t is in seconds. When it momentarily stops its acceleration is: A. 0

B. −73 m/s2

C. −30 m/s2

D. −9.8 m/s2

E. 9.2 × 103 m/s2

ans: C

29. A car, initially at rest, travels 20 m in 4 s along a straight line with constant acceleration. The acceleration of the car is:

A. 0.4 m/s2

B. 1.3 m/s2

C. 2.5 m/s2

D. 4.9 m/s2

E. 9.8 m/s2

ans: C

12 Chapter 2: MOTION ALONG A STRAIGHT LINE

30. A racing car traveling with constant acceleration increases its speed from 10 m/s to 50 m/s over a distance of 60 m. How long does this take?

A. 2.0 s

B. 4.0 s

C. 5.0 s

D. 8.0 s

E. The time cannot be calculated since the speed is not constant

ans: B

31. A car starts from rest and goes down a slope with a constant acceleration of 5 m/s2. After 5 s the car reaches the bottom of the hill. Its speed at the bottom of the hill, in meters per second, is:

A. 1

B. 12.5

C. 25

D. 50

E. 160

ans: C

32. A car moving with an initial velocity of 25 m/s north has a constant acceleration of 3 m/s2 south. After 6 seconds its velocity will be:

A. 7 m/s north

B. 7 m/s south

C. 43 m/s north

D. 20 m/s north

E. 20 m/s south

ans: A

33. An object with an initial velocity of 12 m/s west experiences a constant acceleration of 4 m/s2 west for 3 seconds. During this time the object travels a distance of:

A. 12 m

B. 24 m

C. 36 m

D. 54 m

E. 144 m

ans: D

34. How far does a car travel in 6 s if its initial velocity is 2 m/s and its acceleration is 2 m/s2 in the forward direction?

A. 12 m

B. 14 m

C. 24 m

D. 36 m

E. 48 m

ans: E

Chapter 2: MOTION ALONG A STRAIGHT LINE 13

35. At a stop light, a truck traveling at 15 m/s passes a car as it starts from rest. The truck travels at constant velocity and the car accelerates at 3 m/s2. How much time does the car take to catch up to the truck?

A. 5 s

B. 10 s

C. 15 s

D. 20 s

E. 25 s

ans: B

36. A ball is in free fall. Its acceleration is:

A. downward during both ascent and descent

B. downward during ascent and upward during descent

C. upward during ascent and downward during descent

D. upward during both ascent and descent

E. downward at all times except at the very top, when it is zero

ans: A

37. A ball is in free fall. Upward is taken to be the positive direction. The displacement of the ball during a short time interval is:

A. positive during both ascent and descent

B. negative during both ascent and descent

C. negative during ascent and positive during descent

D. positive during ascent and negative during descent

E. none of the above

ans: D

38. A baseball is thrown vertically into the air. The acceleration of the ball at its highest point is: A. zero

B. g, down

C. g, up

D. 2g, down

E. 2g, up

ans: B

39. Which one of the following statements is correct for an object released from rest? A. The average velocity during the first second of time is 4.9 m/s

B. During each second the object falls 9.8 m

C. The acceleration changes by 9.8 m/s2 every second

D. The object falls 9.8 m during the first second of time

E. The acceleration of the object is proportional to its weight

ans: A

14 Chapter 2: MOTION ALONG A STRAIGHT LINE

40. A freely falling body has a constant acceleration of 9.8 m/s2. This means that: A. the body falls 9.8 m during each second

B. the body falls 9.8 m during the first second only

C. the speed of the body increases by 9.8 m/s during each second

D. the acceleration of the body increases by 9.8 m/s2 during each second E. the acceleration of the body decreases by 9.8 m/s2 during each second ans: C

41. An object is shot vertically upward. While it is rising:

A. its velocity and acceleration are both upward

B. its velocity is upward and its acceleration is downward

C. its velocity and acceleration are both downward

D. its velocity is downward and its acceleration is upward

E. its velocity and acceleration are both decreasing

ans: B

42. An object is thrown straight up from ground level with a speed of 50 m/s. If g = 10 m/s2 its distance above ground level 1.0 s later is:

A. 40 m

B. 45 m

C. 50 m

D. 55 m

E. 60 m

ans: B

43. An object is thrown straight up from ground level with a speed of 50 m/s. If g = 10 m/s2 its distance above ground level 6.0 s later is:

A. 0.00 m

B. 270 m

C. 330 m

D. 480 m

E. none of these

ans: E

44. At a location where g = 9.80 m/s2, an object is thrown vertically down with an initial speed of 1.00 m/s. After 5.00 s the object will have traveled:

A. 125 m

B. 127.5 m

C. 245 m

D. 250 m

E. 255 m

ans: B

Chapter 2: MOTION ALONG A STRAIGHT LINE 15

45. An object is thrown vertically upward at 35 m/s. Taking g = 10 m/s2, the velocity of the object 5 s later is:

A. 7.0 m/s up

B. 15 m/s down

C. 15 m/s up

D. 85 m/s down

E. 85 m/s up

ans: B

46. A feather, initially at rest, is released in a vacuum 12 m above the surface of the earth. Which of the following statements is correct?

A. The maximum velocity of the feather is 9.8 m/s

B. The acceleration of the feather decreases until terminal velocity is reached C. The acceleration of the feather remains constant during the fall

D. The acceleration of the feather increases during the fall

E. The acceleration of the feather is zero

ans: C

47. An object is released from rest. How far does it fall during the second second of its fall? A. 4.9 m

B. 9.8 m

C. 15 m

D. 20 m

E. 25 m

ans: C

48. A heavy ball falls freely, starting from rest. Between the third and fourth second of time it travels a distance of:

A. 4.9 m

B. 9.8 m

C. 29.4 m

D. 34.3 m

E. 39.8 m

ans: D

49. As a rocket is accelerating vertically upward at 9.8 m/s2 near Earth’s surface, it releases a projectile. Immediately after release the acceleration (in m/s2) of the projectile is: A. 9.8 down

B. 0

C. 9.8 up

D. 19.6 up

E. none of the above

ans: A

16 Chapter 2: MOTION ALONG A STRAIGHT LINE

50. A stone is released from a balloon that is descending at a constant speed of 10 m/s. Neglecting air resistance, after 20 s the speed of the stone is:

A. 2160 m/s

B. 1760 m/s

C. 206 m/s

D. 196 m/s

E. 186 m/s

ans: C

51. An object dropped from the window of a tall building hits the ground in 12.0 s. If its acceleration is 9.80 m/s2, the height of the window above the ground is:

A. 29.4 m

B. 58.8 m

C. 118 m

D. 353 m

E. 706 m

ans: E

52. Neglecting the effect of air resistance a stone dropped off a 175-m high building lands on the ground in:

A. 3 s

B. 4 s

C. 6 s

D. 18 s

E. 36 s

ans: C

53. A stone is thrown vertically upward with an initial speed of 19.5 m/s. It will rise to a maximum height of:

A. 4.9 m

B. 9.8 m

C. 19.4 m

D. 38.8 m

E. none of these

ans: C

54. A baseball is hit straight up and is caught by the catcher 2.0 s later. The maximum height of the ball during this interval is:

A. 4.9 m

B. 7.4 m

C. 9.8 m

D. 12.6 m

E. 19.6 m

ans: A

Chapter 2: MOTION ALONG A STRAIGHT LINE 17

55. An object is thrown straight down with an initial speed of 4 m/s from a window which is 8 m above the ground. The time it takes the object to reach the ground is:

A. 0.80 s

B. 0.93 s

C. 1.3 s

D. 1.7 s

E. 2.0 s

ans: B

56. A stone is released from rest from the edge of a building roof 190 m above the ground. Ne glecting air resistance, the speed of the stone, just before striking the ground, is: A. 43 m/s

B. 61 m/s

C. 120 m/s

D. 190 m/s

E. 1400 m/s

ans: B

57. An object is thrown vertically upward with a certain initial velocity in a world where the acceleration due to gravity is 19.6 m/s2. The height to which it rises is that to which the object would rise if thrown upward with the same initial velocity on the Earth. Neglect friction.

A. half

B. √2 times

C. twice

D. four times

E. cannot be calculated from the given data

ans: A

58. A projectile is shot vertically upward with a given initial velocity. It reaches a maximum height of 100 m. If, on a second shot, the initial velocity is doubled then the projectile will reach a maximum height of:

A. 70.7 m

B. 141.4 m

C. 200 m

D. 241 m

E. 400 m

ans: E

59. One object is thrown vertically upward with an initial velocity of 100 m/s and another object with an initial velocity of 10 m/s. The maximum height reached by the first object will be that of the other.

A. 10 times

B. 100 times

C. 1000 times

D. 10, 000 times

E. none of these

ans: B

18 Chapter 2: MOTION ALONG A STRAIGHT LINE

60. The area under a velocity-time graph represents:

A. acceleration

B. change in acceleration

C. speed

D. change in velocity

E. displacement

ans: E

61. Displacement can be obtained from:

A. the slope of an acceleration-time graph

B. the slope of a velocity-time graph

C. the area under an acceleration-time graph

D. the area under a velocity-time graph

E. the slope of an acceleration-time graph

ans: D

62. An object has a constant acceleration of 3 m/s2. The coordinate versus time graph for this object has a slope:

A. that increases with time

B. that is constant

C. that decreases with time

D. of 3 m/s

E. of 3 m/s2

ans: A

63. The coordinate-time graph of an object is a straight line with a positive slope. The object has: A. constant displacement

B. steadily increasing acceleration

C. steadily decreasing acceleration

D. constant velocity

E. steadily increasing velocity

ans: D

Chapter 2: MOTION ALONG A STRAIGHT LINE 19

64. Which of the following five coordinate versus time graphs represents the motion of an object moving with a constant nonzero speed?

x

................................................................t A

x

............................................................ t B

x

...........................................

t

C

x

...........................................t

E

ans: B

................................................................t D

x

65. Which of the following five acceleration versus time graphs is correct for an object moving in a straight line at a constant velocity of 20 m/s?

a

...........................................

t

A

a

............................................................t B

a

................................................................t C

a

........................................... t

E

ans: E

............................................................ t

D

a

20 Chapter 2: MOTION ALONG A STRAIGHT LINE

66. Which of the following five coordinate versus time graphs represents the motion of an object whose speed is increasing?

x

................................................................t A

x

............................................................ t B

x

................................................................ t C

............................................................

x

t

E

ans: A

................................................................t D

x

67. A car accelerates from rest on a straight road. A short time later, the car decelerates to a stop and then returns to its original position in a similar manner, by speeding up and then slowing to a stop. Which of the following five coordinate versus time graphs best describes the motion?

x

x

x

............................................................. t

................................................................................................... t t

....................................................................................................

A

x

B

x

C

...............................................................t

t

D

ans: E

............................................................................... E

Chapter 2: MOTION ALONG A STRAIGHT LINE 21

68. The acceleration of an object, starting from rest, is shown in the graph below. Other than at t = 0, when is the velocity of the object equal to zero?

a(m/s2)

.......................................................................................................................................................................................................................................................

5

4

t(s)

5

−5

123

A. During the interval from 1.0 s to 3.0 s

B. At t = 3.5 s

C. At t = 4.0 s

D. At t = 5.0 s

E. At no other time less than or equal to 5 s

ans: E

69. An elevator is moving upward with constant acceleration. The dashed curve shows the position y of the ceiling of the elevator as a function of the time t. At the instant indicated by the dot, a bolt breaks loose and drops from the ceiling. Which curve best represents the position of the bolt as a function of time?

y

ans: B

..................................................... A

........ ........ ............ ............. ............. ........... ......... ........ ..................................................................

................................................................................................................................................................................................................................................................................................ B .................................. C

..................................................................................... D

..................................... E

t

22 Chapter 2: MOTION ALONG A STRAIGHT LINE

70. The diagram shows a velocity-time graph for a car moving in a straight line. At point Q the car must be:

v

P

.................................................................................................................................................................

s

t

sQ

A. moving with zero acceleration

B. traveling downhill

C. traveling below ground-level

D. reducing speed

E. traveling in the reverse direction to that at point P ans: E

71. The diagram shows a velocity-time graph for a car moving in a straight line. At point P the car must be:

v

......................................................................................................................................................

P

s

t

A. moving with zero acceleration

B. climbing the hill

C. accelerating

D. stationary

E. moving at about 45◦ with respect to the x axis

ans: C

Chapter 2: MOTION ALONG A STRAIGHT LINE 23

72. The graph represents the straight line motion of a car. How far does the car travel between t = 2 s and t = 5 s?

v(m/s)

25 9 ................................................................................................................................................................................

12

6

t(s)

A. 4 m

B. 12 m

C. 24 m

D. 36 m

E. 60 m

ans: D

73. The diagram represents the straight line motion of a car. Which of the following statements is true?

v(m/s)

12 6

25 9 ................................................................................................................................................................................

t(s)

A. The car accelerates, stops, and reverses

B. The car accelerates at 6 m/s2 for the first 2 s C. The car is moving for a total time of 12 s

D. The car decelerates at 12 m/s2 for the last 4 s E. The car returns to its starting point when t =9s ans: B

24 Chapter 2: MOTION ALONG A STRAIGHT LINE

74. Consider the following five graphs (note the axes carefully). Which of these represents motion at constant speed?

x

............................................................t I

v

v

............................................................t II

a

a

............................................................t III

...........................................

t

V

A. IV only

B. IV and V only

C. I, II, and III only

D. I and II only

E. I and IV only

ans: E

...........................................

t

IV

75. An object is dropped from rest. Which of the following five graphs correctly represents its motion? The positive direction is taken to be downward.

v

...........................................

t

A

v

............................................................t B

v

................................................................t C

v

ans: B

................................................................t D

y

................................................ .............................................. E

t

Chapter 2: MOTION ALONG A STRAIGHT LINE 25

76. A stone is dropped from a cliff. The graph (carefully note the axes) which best represents its motion while it falls is:

x

............................................................t A

v

................................................................t B

v

............................................................t C

a

............................................................t

E

ans: C

................................................................t D

a

77. An object is thrown vertically into the air. Which of the following five graphs represents the velocity (v) of the object as a function of the time (t)? The positive direction is taken to be upward.

v

............................................................t A

v

...........................................

t

B

v

............................................................ t C

v

................................................................t

E

ans: C

................................................................t D

v

26 Chapter 2: MOTION ALONG A STRAIGHT LINE

Chapter 3: VECTORS

1. We say that the displacement of a particle is a vector quantity. Our best justification for this assertion is:

A. displacement can be specified by a magnitude and a direction

B. operating with displacements according to the rules for manipulating vectors leads to re sults in agreement with experiments

C. a displacement is obviously not a scalar

D. displacement can be specified by three numbers

E. displacement is associated with motion

ans: B

2. The vectors na, nb, and nc are related by nc = nb − na. Which diagram below illustrates this relationship?

...................................................................... ....... .... ......... ....... ...... ...................................................................................................................................... ........ .... .... .... .... .... .... .... .... .... .... .... ..... .... .... .... .... ..... .... .... .... .... ..... .... .... .... .... ..... .... .... .... .... ...................

.......................................................................................................................................................... ............ ...................................................................... ....... .... ........ ....... ...... ..........................................................................................................................................

...................................................................... ....... .... ........ ....... ..... .......................................................................................................................................... .................................................................................................................. ......................

...................................................................... ....... .... ........ ....... ...... ............................................................................................................................................................................................................................................................... ......................

..................

na

nc A

nb

na

nc B

nb

nb nc

na

C

nb nc

na

D

E. None of these

ans: D

3. A vector of magnitude 3 CANNOT be added to a vector of magnitude 4 so that the magnitude of the resultant is:

A. zero

B. 1

C. 3

D. 5

E. 7

ans: A

4. A vector of magnitude 20 is added to a vector of magnitude 25. The magnitude of this sum might be:

A. zero

B. 3

C. 12

D. 47

E. 50

ans: C

Chapter 3: VECTORS 27

5. A vector Sn of magnitude 6 and another vector Tn have a sum of magnitude 12. The vector Tn: A. must have a magnitude of at least 6 but no more than 18

B. may have a magnitude of 20

C. cannot have a magnitude greater than 12

D. must be perpendicular to Sn

E. must be perpendicular to the vector sum

ans: A

6. The vector −An is:

A. greater than An in magnitude

B. less than An in magnitude

C. in the same direction as An

D. in the direction opposite to An

E. perpendicular to An

ans: D

7. The vector Vn3 in the diagram is equal to:

.............................................................................................................................................. ..... . ........ ... ........................................................................................................................................................................................................ ........

Vn2 Vn3

................................................................................

θ

Vn1

A. Vn1 − Vn2

B. Vn1 + Vn2

C. Vn2 − Vn1

D. Vn1 cos θ

E. Vn1/(cos θ)

ans: C

8. If |An + Bn |2 = A2 + B2, then:

A. An and Bn must be parallel and in the same direction B. An and Bn must be parallel and in opposite directions C. either An or Bn must be zero

D. the angle between An and Bn must be 60◦

E. none of the above is true

ans: E

28 Chapter 3: VECTORS

9. If |An + Bn | = A + B and neither An nor Bn vanish, then:

A. An and Bn are parallel and in the same direction

B. An and Bn are parallel and in opposite directions

C. the angle between An and Bn is 45◦

D. the angle between An and Bn is 60◦

E. An is perpendicular to Bn

ans: A

10. If |An − Bn | = A + B and neither An nor Bn vanish, then:

A. An and Bn are parallel and in the same direction

B. An and Bn are parallel and in opposite directions

C. the angle between An and Bn is 45◦

D. the angle between An and Bn is 60◦

E. An is perpendicular to Bn

ans: B

11. Four vectors (An, Bn , Cn , Dn ) all have the same magnitude. The angle θ between adjacent vectors is 45◦ as shown. The correct vector equation is:

........................................................................................... ..... ........ ... ........................................................................ ....

.............................................................. An BnCn

45◦

...........................

45◦

Dn

A. An − Bn − Cn + Dn = 0

B. Bn + Dn − √2Cn = 0

C. An + Bn = Bn + Dn

D. An + Bn + Cn + Dn = 0

E. (An + Cn )/√2 = −Bn

ans: B

.......................................................

............................................................... .... . ......... 45◦

12. Vectors An and Bn lie in the xy plane. We can deduce that An = Bn if:

A. A2x + A2y = B2x + B2y

B. Ax + Ay = Bx + By

C. Ax = Bx and Ay = By

D. Ay/Ax = By/Bx

E. Ax = Ay and Bx = By

ans: C

Chapter 3: VECTORS 29

13. A vector has a magnitude of 12. When its tail is at the origin it lies between the positive x axis and the negative y axis and makes an angle of 30◦ with the x axis. Its y component is: A. 6/√3

B. −6√3

C. 6

D. −6

E. 12

ans: D

14. If the x component of a vector An, in the xy plane, is half as large as the magnitude of the vector, the tangent of the angle between the vector and the x axis is:

A. √3

B. 1/2

C. √3/2

D. 3/2

E. 3

ans: D

15. If An = (6 m)ˆi − (8 m)ˆj then 4An has magnitude:

A. 10 m

B. 20 m

C. 30 m

D. 40 m

E. 50 m

ans: D

16. A vector has a component of 10 m in the +x direction, a component of 10 m in the +y direction, and a component of 5 m in the +z direction. The magnitude of this vector is: A. zero

B. 15 m

C. 20 m

D. 25 m

E. 225 m

ans: B

17. Let Vn = (2.00 m)ˆi + (6.00 m)ˆj − (3.00 m) ˆk. The magnitude of Vn is:

A. 5.00 m

B. 5.57 m

C. 7.00 m

D. 7.42 m

E. 8.54 m

ans: C

30 Chapter 3: VECTORS

18. A vector in the xy plane has a magnitude of 25 m and an x component of 12 m. The angle it makes with the positive x axis is:

A. 26◦

B. 29◦

C. 61◦

D. 64◦

E. 241◦

ans: C

19. The angle between An = (25 m)ˆi + (45 m)ˆj and the positive x axis is:

A. 29◦

B. 61◦

C. 151◦

D. 209◦

E. 241◦

ans: B

20. The angle between An = (−25 m)ˆi + (45 m)ˆj and the positive x axis is: A. 29◦

B. 61◦

C. 119◦

D. 151◦

E. 209◦

ans: C

21. Let An = (2 m)ˆi+ (6 m)ˆj−(3 m) ˆk and Bn = (4 m)ˆi+ (2 m)ˆj+ (1 m) ˆk. The vector sum Sn = An +Bn is:

A. (6 m)ˆi + (8 m)ˆj − (2 m) ˆk

B. (−2 m)ˆi + (4 m)ˆj − (4 m) ˆk

C. (2 m)ˆi − (4 m)ˆj + (4 m) ˆk

D. (8 m)ˆi + (12 m)ˆj − (3 m) ˆk

E. none of these

ans: A

22. Let An = (2 m)ˆi + (6 m)ˆj − (3 m) ˆk and Bn = (4 m)ˆi + (2 mˆj + (1 m) ˆk. The vector difference Dn = An − Bn is:

A. (6 m)ˆi + (8 m)ˆj − (2 m) ˆk

B. (−2 m)ˆi + (4 m)ˆj − (4 m) ˆk

C. (2 m)ˆi − (4 m)ˆj + (4 m) ˆk

D. (8 m)ˆi + (12 m)ˆj − (3 m) ˆk

E. none of these

ans: B

Chapter 3: VECTORS 31

23. If An = (2 m)ˆi − (3 m)ˆj and Bn = (1 m)ˆi − (2 m)ˆj, then An − 2Bn =

A. (1 m)ˆj

B. (−1 m)ˆj

C. (4 m)ˆi − (7 m)ˆj

D. (4 m)ˆi + (1 m)ˆj

E. (−4 m)ˆi + (7 m)ˆj

ans: A

24. In the diagram, An has magnitude 12 m and Bn has magnitude 8 m. The x component of An + Bn is about:

y

...................................................................................................... ..... .................................................................. .........

................................................

60 An ◦

A. 5.5 m B. 7.6 m C. 12 m D. 14 m E. 15 m ans: C

........................................

45◦

Bn

x

25. A certain vector in the xy plane has an x component of 4 m and a y component of 10 m. It is then rotated in the xy plane so its x component is doubled. Its new y component is about: A. 20 m

B. 7.2 m

C. 5.0 m

D. 4.5 m

E. 2.2 m

ans: B

26. Vectors An and Bn each have magnitude L. When drawn with their tails at the same point, the angle between them is 30◦. The value of An · Bn is:

A. zero

B. L2

C. √3L2/2

D. 2L2

E. none of these

ans: C

32 Chapter 3: VECTORS

27. Let An = (2 m)ˆi + (6 m)ˆj − (3 m) ˆk and Bn = (4 m)ˆi + (2 m)ˆj + (1 m) ˆk. Then An · Bn = A. (8 m)ˆi + (12 m)ˆj − (3 m) ˆk

B. (12 m)ˆi − (14 m)ˆj − (20 m) ˆk

C. 23 m2

D. 17 m2

E. none of these

ans: D

28. Two vectors have magnitudes of 10 m and 15 m. The angle between them when they are drawn with their tails at the same point is 65◦. The component of the longer vector along the line of the shorter is:

A. 0

B. 4.2 m

C. 6.3 m

D. 9.1 m

E. 14 m

ans: C

29. Let Sn = (1 m)ˆi + (2 m)ˆj + (2 m) ˆk and Tn = (3 m)ˆi + (4 m) ˆk. The angle between these two vectors is given by:

A. cos−1(14/15)

B. cos−1(11/225)

C. cos−1(104/225)

D. cos−1(11/15)

E. cannot be found since Sn and Tn do not lie in the same plane

ans: D

30. Two vectors lie with their tails at the same point. When the angle between them is increased by 20◦ their scalar product has the same magnitude but changes from positive to negative. The original angle between them was:

A. 0

B. 60◦

C. 70◦

D. 80◦

E. 90◦

ans: D

31. If the magnitude of the sum of two vectors is less than the magnitude of either vector, then: A. the scalar product of the vectors must be negative

B. the scalar product of the vectors must be positive

C. the vectors must be parallel and in opposite directions

D. the vectors must be parallel and in the same direction

E. none of the above

ans: A

Chapter 3: VECTORS 33

32. If the magnitude of the sum of two vectors is greater than the magnitude of either vector, then: A. the scalar product of the vectors must be negative

B. the scalar product of the vectors must be positive

C. the vectors must be parallel and in opposite directions

D. the vectors must be parallel and in the same direction

E. none of the above

ans: E

33. Vectors An and Bn each have magnitude L. When drawn with their tails at the same point, the angle between them is 60◦. The magnitude of the vector product An × Bn is: A. L2/2

B. L2

C. √3L2/2

D. 2L2

E. none of these

ans: C

34. Two vectors lie with their tails at the same point. When the angle between them is increased by 20◦ the magnitude of their vector product doubles. The original angle between them was about:

A. 0

B. 18◦

C. 25◦

D. 45◦

E. 90◦

ans: B

35. Two vectors have magnitudes of 10 m and 15 m. The angle between them when they are drawn with their tails at the same point is 65◦. The component of the longer vector along the line perpendicular to the shorter vector, in the plane of the vectors, is:

A. 0

B. 4.2 m

C. 6.3 m

D. 9.1 m

E. 14 m

ans: E

36. The two vectors (3 m)ˆi − (2 m)ˆj and (2 m)ˆi + (3 m)ˆj − (2 m) ˆk define a plane. It is the plane of the triangle with both tails at one vertex and each head at one of the other vertices. Which of the following vectors is perpendicular to the plane?

A. (4 m)ˆi + (6 m)ˆj + (13 m) ˆk

B. (−4 m)ˆi + (6 m)ˆj + (13 m) ˆk

C. (4 m)ˆi − (6 m)ˆj + (13 m) ˆk

D. (4 m)ˆi + (6 mˆj − (13 m) ˆk

E. (4 m)ˆi + (6 m)ˆj

ans: A

34 Chapter 3: VECTORS

37. Let Rn = Sn × Tn and θ W= 90◦, where θ is the angle between Sn and Tn when they are drawn with their tails at the same point. Which of the following is NOT true?

A. |Rn | = |Sn||Tn|sin θ

B. −Rn = Tn × Sn

C. Rn · Sn = 0

D. Rn · Tn = 0

E. Sn · Tn = 0

ans: E

38. The value of ˆi · (ˆj × ˆk) is:

A. zero

B. +1

C. −1

D. 3

E. √3

ans: B

39. The value of ˆk · ( ˆk × ˆi) is:

A. zero

B. +1

C. −1

D. 3

E. √3

ans: A

Chapter 3: VECTORS 35

Chapter 4: MOTION IN TWO AND THREE DIMENSIONS

1. Velocity is defined as:

A. rate of change of position with time

B. position divided by time

C. rate of change of acceleration with time

D. a speeding up or slowing down

E. change of position

ans: A

2. Acceleration is defined as:

A. rate of change of position with time

B. speed divided by time

C. rate of change of velocity with time

D. a speeding up or slowing down

E. change of velocity

ans: C

3. Which of the following is a scalar quantity?

A. Speed

B. Velocity

C. Displacement

D. Acceleration

E. None of these

ans: A

4. Which of the following is a vector quantity?

A. Mass

B. Density

C. Speed

D. Temperature

E. None of these

ans: E

5. Which of the following is NOT an example of accelerated motion? A. Vertical component of projectile motion

B. Circular motion at constant speed

C. A swinging pendulum

D. Earth’s motion about sun

E. Horizontal component of projectile motion

ans: E

36 Chapter 4: MOTION IN TWO AND THREE DIMENSIONS

6. A particle goes from x = −2 m, y = 3 m, z = 1 m to x = 3 m, y = −1 m, z = 4 m. Its displacement is:

A. (1 m)ˆi + (2 m)ˆj + (5 m) ˆk

B. (5 m)ˆi − (4 m)ˆj + (3 m) ˆk

C. −(5 m)ˆi + (4 m)ˆj − (3 m) ˆk

D. −(1 m)ˆi − (2 m)ˆj − (5 m) ˆk

E. −(5 m)ˆi − (2 m)ˆj + (3 m) ˆk

ans: B

7. A jet plane in straight horizontal flight passes over your head. When it is directly above you, the sound seems to come from a point behind the plane in a direction 30◦ from the vertical. The speed of the plane is:

A. the same as the speed of sound

B. half the speed of sound

C. three-fifths the speed of sound

D. 0.866 times the speed of sound

E. twice the speed of sound

ans: B

8. A plane traveling north at 200 m/s turns and then travels south at 200 m/s. The change in its velocity is:

A. zero

B. 200 m/s north

C. 200 m/s south

D. 400 m/s north

E. 400 m/s south

ans: E

9. Two bodies are falling with negligible air resistance, side by side, above a horizontal plane. If one of the bodies is given an additional horizontal acceleration during its descent, it: A. strikes the plane at the same time as the other body

B. strikes the plane earlier than the other body

C. has the vertical component of its velocity altered

D. has the vertical component of its acceleration altered

E. follows a straight line path along the resultant acceleration vector

ans: A

10. The velocity of a projectile equals its initial velocity added to:

A. a constant horizontal velocity

B. a constant vertical velocity

C. a constantly increasing horizontal velocity

D. a constantly increasing downward velocity

E. a constant velocity directed at the target

ans: D

Chapter 4: MOTION IN TWO AND THREE DIMENSIONS 37

11. A stone thrown from the top of a tall building follows a path that is:

A. circular

B. made of two straight line segments

C. hyperbolic

D. parabolic

E. a straight line

ans: D

12. Identical guns fire identical bullets horizontally at the same speed from the same height above level planes, one on the Earth and one on the Moon. Which of the following three statements is/are true?

I. The horizontal distance traveled by the bullet is greater for the Moon.

II. The flight time is less for the bullet on the Earth.

III. The velocity of the bullets at impact are the same.

A. III only

B. I and II only

C. I and III only

D. II and III only

E. I, II, III

ans: B

13. A stone is thrown horizontally and follows the path XYZ shown. The direction of the acceler ation of the stone at point Y is:

•

..................................................................................................................................................................................................................................................................................................................................

X •

Y

Z • horizontal

A. ↓

B. →

C. 9

D. t

E. c

ans: A

38 Chapter 4: MOTION IN TWO AND THREE DIMENSIONS

14. A bullet shot horizontally from a gun:

A. strikes the ground much later than one dropped vertically from the same point at the same instant

B. never strikes the ground

C. strikes the ground at approximately the same time as one dropped vertically from the same point at the same instant

D. travels in a straight line

E. strikes the ground much sooner than one dropped from the same point at the same instant ans: C

15. A bomber flying in level flight with constant velocity releases a bomb before it is over the target. Neglecting air resistance, which one of the following is NOT true?

A. The bomber is over the target when the bomb strikes

B. The acceleration of the bomb is constant

C. The horizontal velocity of the plane equals the vertical velocity of the bomb when it hits the target

D. The bomb travels in a curved path

E. The time of flight of the bomb is independent of the horizontal speed of the plane ans: C

16. The airplane shown is in level flight at an altitude of 0.50 km and a speed of 150 km/h. At what distance d should it release a heavy bomb to hit the target X? Take g = 10 m/s2.

.................................................... ..................... .............. ........ ...................................................... ................... ............. ........................

150 km/h

↑| ||

...................... ............. .................

......................... ....... .......

......................................................... ................ .......

0.5 km ||

|↓

X •

A. 150 m

B. 295 m

C. 420 m

D. 2550 m E. 15, 000 m ans: C

...............................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................

←−−−−−−−− d −−−−−−−−→

Chapter 4: MOTION IN TWO AND THREE DIMENSIONS 39

17. An object is shot from the back of a railroad flatcar moving at 40 km/h on a straight horizontal road. The launcher is aimed upward, perpendicular to the bed of the flatcar. The object falls: A. in front of the flatcar

B. behind the flatcar

C. on the flatcar

D. either behind or in front of the flatcar, depending on the initial speed of the object E. to the side of the flatcar

ans: C

18. A ball is thrown horizontally from the top of a 20-m high hill. It strikes the ground at an angle of 45◦. With what speed was it thrown?

........................................................................................................................................................

....................................................................................................................................................................................................................................................................................................................................................................................................................... ...................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................... .......... ↑||

20 m

.........

........ ........ ..................................

........

||↓ 45◦

.............

A. 14 m/s

B. 20 m/s

C. 28 m/s

D. 32 m/s

E. 40 m/s

ans: B

......... ......... ........

19. A stone is thrown outward from the top of a 59.4-m high cliff with an upward velocity compo nent of 19.5 m/s. How long is stone in the air?

A. 4.00 s

B. 5.00 s

C. 6.00 s

D. 7.00 s

E. 8.00 s

ans: C

20. A large cannon is fired from ground level over level ground at an angle of 30◦ above the horizontal. The muzzle speed is 980 m/s. Neglecting air resistance, the projectile will travel what horizontal distance before striking the ground?

A. 4.3 km

B. 8.5 km

C. 43 km

D. 85 km

E. 170 km

ans: D

40 Chapter 4: MOTION IN TWO AND THREE DIMENSIONS

21. A boy on the edge of a vertical cliff 20 m high throws a stone horizontally outward with a speed of 20 m/s. It strikes the ground at what horizontal distance from the foot of the cliff? Use g = 10 m/s2.

A. 10 m

B. 40 m

C. 50 m

D. 50√5 m

E. none of these

ans: B

22. Which of the curves on the graph below best represents the vertical component vy of the velocity versus the time t for a projectile fired at an angle of 45◦ above the horizontal?

vy A

O

............................................................................................. ............................................................................ .

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

................................................................................

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

F B

C

t

...

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

.

..........................................................................

.

.

.

.

E

D

A. OC

B. DE

C. AB

D. AE

E. AF

ans: D

Chapter 4: MOTION IN TWO AND THREE DIMENSIONS 41

23. A cannon fires a projectile as shown. The dashed line shows the trajectory in the absence of gravity; points MNOP correspond to the position of the projectile at one second intervals. If g = 10 m/s2, the lengths X,Y,Z are:

.......................... .................. ......... ............................. .......... .................

•M • X

Y

Z

.............................................................................................................................................................................................

A. 5 m, 10 m, 15 m B. 5 m, 20 m, 45 m C. 10 m, 40 m, 90 m D. 10 m, 20 m, 30 m E. 0.2 m, 0.8 m, 1.8 m ans: B

......... .......... .......... .......... .................................................................................................................................................................................................................................

.............

....

.................................................................................. ...... ............................... .... ..........................................................................•

..................................

N •

O

•

P

24. A dart is thrown horizontally toward X at 20 m/s as shown. It hits Y 0.1 s later. The distance XY is:

...... ...... ...... ....... ....... ....... ...... ....... ....... ...... ....... ....... ...... ....... ....... ...... ....... ....... ....... ...... ....... ............................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................

••••

•

......... ........................................... .... .... ................................................................................

.... ...... ..... ...... ..... ..... ..... ...... ..... ...... ..... ...... ................... .................................. X

•

............................................................................................................................................................................................................................................................................................................................................•....

A. 2 m

B. 1 m

C. 0.5 m D. 0.1 m E. 0.05 m ans: E

••

•

•••

••

.... ...... ..... ...... ..... ..... ..... ...... ..... ...... ..... ...... ................... .................................. Y

42 Chapter 4: MOTION IN TWO AND THREE DIMENSIONS

25. A projectile is fired from ground level over level ground with an initial velocity that has a vertical component of 20 m/s and a horizontal component of 30 m/s. Using g = 10 m/s2, the distance from launching to landing points is:

A. 40 m

B. 60 m

C. 80 m

D. 120 m

E. 180 m

ans: D

26. An object, tied to a string, moves in a circle at constant speed on a horizontal surface as shown. The direction of the displacement of this object, as it travels from W to X is:

•

......................................................................... ... .... ..... ...... ........ ......... ....................................... ........ ....... ..... .... .... .......................................................................................................................................................................................................................................................................................................................

W

X ...............................••••••••••

•

Z

Y

•

•

A. ←

B. ↓

C. ↑

D. c

E. t

ans: E

•

..................................................................................

27. A toy racing car moves with constant speed around the circle shown below. When it is at point A its coordinates are x = 0, y = 3 m and its velocity is (6 m/s)ˆi. When it is at point B its velocity and acceleration are:

y

•A

......................................................................... ... .... .... ....... ........ ......... ...................................... ........ ...... ...... .... .... .....................................................................................................................................................................................................................................................................................................................x

• B

A. −(6 m/s)ˆj and (12 m/s2)ˆi, respectively

B. (6 m/s)ˆi and −(12 m/s2)ˆi, respectively

C. (6 m/s)ˆj and (12 m/s2)ˆi, respectively

D. (6 m/s)ˆi and (2 m/s2)ˆj, respectively

E. (6 m/s)ˆj and 0, respectively

ans: C

Chapter 4: MOTION IN TWO AND THREE DIMENSIONS 43

28. An airplane makes a gradual 90◦ turn while flying at a constant speed of 200 m/s. The process takes 20.0 seconds to complete. For this turn the magnitude of the average acceleration of the plane is:

A. zero

B. 40 m/s2

C. 20 m/s2

D. 14 m/s2

E. 10 m/s2

ans: D

29. An airplane is flying north at 500 km/h. It makes a gradual 180◦ turn at constant speed, changing its direction of travel from north through east to south. The process takes 40 s. The average acceleration of the plane for this turn (in km/h·s) is:

A. 12.5 km/h · s, north

B. 12.5 km/h · s, east

C. 12.5 km/h · s, south

D. 25 km/h · s, north

E. 25 km/h · s, south

ans: E

30. An object is moving on a circular path of radius π meters at a constant speed of 4.0 m/s. The time required for one revolution is:

A. 2/π2 s

B. π2/2 s

C. π/2 s

D. π2/4

E. 2/π s

ans: B

31. A particle moves at constant speed in a circular path. The instantaneous velocity and instan taneous acceleration vectors are:

A. both tangent to the circular path

B. both perpendicular to the circular path

C. perpendicular to each other

D. opposite to each other

E. none of the above

ans: C

32. A stone is tied to a string and whirled at constant speed in a horizontal circle. The speed is then doubled without changing the length of the string. Afterward the magnitude of the acceleration of the stone is:

A. the same

B. twice as great

C. four times as great

D. half as great

E. one-fourth as great

ans: C

44 Chapter 4: MOTION IN TWO AND THREE DIMENSIONS

33. Two objects are traveling around different circular orbits with constant speed. They both have the same acceleration but object A is traveling twice as fast as object B. The orbit radius for object A is the orbit radius for object B.

A. one-fourth

B. one-half

C. the same as

D. twice

E. four times

ans: E

34. A stone is tied to a 0.50-m string and whirled at a constant speed of 4.0 m/s in a vertical circle. Its acceleration at the top of the circle is:

A. 9.8 m/s2, up

B. 9.8 m/s2, down

C. 8.0 m/s2, down

D. 32 m/s2, up

E. 32 m/s2, down

ans: E

35. A stone is tied to a 0.50-m string and whirled at a constant speed of 4.0 m/s in a vertical circle. Its acceleration at the bottom of the circle is:

A. 9.8 m/s2, up

B. 9.8 m/s2, down

C. 8.0 m/s2, up

D. 32 m/s2, up

E. 32 m/s2, down

ans: D

36. A car rounds a 20-m radius curve at 10 m/s. The magnitude of its acceleration is:

A. 0

B. 0.20 m/s2

C. 5.0 m/s2

D. 40 m/s2

E. 400 m/s2

ans: C

37. For a biological sample in a 1.0-m radius centrifuge to have a centripetal acceleration of 25g its speed must be:

A. 11 m/s

B. 16 m/s

C. 50 m/s

D. 122 m/s

E. 245 m/s

ans: B

Chapter 4: MOTION IN TWO AND THREE DIMENSIONS 45

38. A girl jogs around a horizontal circle with a constant speed. She travels one fourth of a revolution, a distance of 25 m along the circumference of the circle, in 5.0 s. The magnitude of her acceleration is:

A. 0.31 m/s2

B. 1.3 m/s2

C. 1.6 m/s2

D. 3.9 m/s2

E. 6.3 m/s2

ans: C

39. A stone is tied to the end of a string and is swung with constant speed around a horizontal circle with a radius of 1.5 m. If it makes two complete revolutions each second, the magnitude of its acceleration is:

A. 0.24 m/s2

B. 2.4 m/s2

C. 24 m/s2

D. 240 m/s2

E. 2400 m/s2

ans: D

40. A Ferris wheel with a radius of 8.0 m makes 1 revolution every 10 s. When a passenger is at the top, essentially a diameter above the ground, he releases a ball. How far from the point on the ground directly under the release point does the ball land?

A. 0

B. 1.0 m

C. 8.0 m

D. 9.1 m

E. 16 m

ans: D

41. A boat is able to move through still water at 20 m/s. It makes a round trip to a town 3.0 km upstream. If the river flows at 5 m/s, the time required for this round trip is: A. 120 s

B. 150 s

C. 200 s

D. 300 s

E. 320 s

ans: E

46 Chapter 4: MOTION IN TWO AND THREE DIMENSIONS

42. A boat is traveling upstream at 14 km/h with respect to a river that is flowing at 6 km/h (with respect to the ground). A man runs directly across the boat, from one side to the other, at 6 km/h (with respect to the boat). The speed of the man with respect to the ground is: A. 10 km/h

B. 14 km/h

C. 18.5 km/h

D. 21 km/h

E. 26 km/h

ans: A

43. A ferry boat is sailing at 12 km/h 30◦ W of N with respect to a river that is flowing at 6.0 km/h E. As observed from the shore, the ferry boat is sailing:

A. 30◦ E of N

B. due N

C. 30◦ W of N

D. 45◦ E of N

E. none of these

ans: B

44. A boy wishes to row across a river in the shortest possible time. He can row at 2 m/s in still water and the river is flowing at 1 m/s. At what angle θ should he point the bow (front) of his boat?

.........

∼∼∼∼

........ .........

......................................................... ............... .......

∼∼∼∼ ∼∼∼∼ ......... ......... ........

..........................................................................................

1 m/s

∼∼∼∼

θ

A. 30◦

B. 45◦

C. 60◦

D. 63◦

E. 90◦

ans: E

.................. ∼∼∼∼ ...... ....... .................................................................................... ...........

Chapter 4: MOTION IN TWO AND THREE DIMENSIONS 47

45. A girl wishes to swim across a river to a point directly opposite as shown. She can swim at 2 m/s in still water and the river is flowing at 1 m/s. At what angle θ with respect to the line joining the starting and finishing points should she swim?

finish

•

................... ......... .......................... ........................... .......... ....

θ .............................................................................. ........ ................1 m/s∼∼∼∼

...............................................................................

∼∼∼∼

∼∼∼∼

∼∼∼∼ ∼∼∼∼∼∼∼∼

•

start

A. 30◦

B. 45◦

C. 60◦

D. 63◦

E. 90◦

ans: A

46. A motor boat can travel at 10 km/h in still water. A river flows at 5 km/h west. A boater wishes to cross from the south bank to a point directly opposite on the north bank. At what angle must the boat be headed?

A. 27◦ E of N

B. 30◦ E of N

C. 45◦ E of N

D. 60◦ E of N

E. depends on the width of the river

ans: B

47. Two projectiles are in flight at the same time. The acceleration of one relative to the other: A. is always 9.8 m/s2

B. can be as large as 19.8 m/s2

C. can be horizontal

D. is zero

E. none of these

ans: D

48 Chapter 4: MOTION IN TWO AND THREE DIMENSIONS

Chapter 5: FORCE AND MOTION – I

1. An example of an inertial reference frame is:

A. any reference frame that is not accelerating

B. a frame attached to a particle on which there are no forces

C. any reference frame that is at rest

D. a reference frame attached to the center of the universe

E. a reference frame attached to Earth

ans: B

2. An object moving at constant velocity in an inertial frame must:

A. have a net force on it

B. eventually stop due to gravity

C. not have any force of gravity on it

D. have zero net force on it

E. have no frictional force on it

ans: D

3. In SI units a force is numerically equal to the , when the force is applied to it. A. velocity of the standard kilogram

B. speed of the standard kilogram

C. velocity of any object

D. acceleration of the standard kilogram

E. acceleration of any object

ans: D

4. Which of the following quantities is NOT a vector?

A. Mass

B. Displacement

C. Weight

D. Acceleration

E. Force

ans: A

5. A newton is the force:

A. of gravity on a 1 kg body

B. of gravity on a 1 g body

C. that gives a 1 g body an acceleration of 1 cm/s2

D. that gives a 1 kg body an acceleration of 1 m/s2

E. that gives a 1 kg body an acceleration of 9.8 m/s2

ans: D

Chapter 5: FORCE AND MOTION – I 49

6. The unit of force called the newton is:

A. 9.8 kg · m/s2

B. 1 kg · m/s2

C. defined by means of Newton’s third law

D. 1 kg of mass

E. 1 kg of force

ans: B

7. A force of 1 N is:

A. 1 kg/s

B. 1 kg · m/s

C. 1 kg · m/s2

D. 1 kg · m2/s

E. 1 kg · m2/s2

ans: C

8. The standard 1-kg mass is attached to a compressed spring and the spring is released. If the mass initially has an acceleration of 5.6 m/s2, the force of the spring has a magnitude of:

A. 2.8 N

B. 5.6 N

C. 11.2 N

D. 0

E. an undetermined amount

ans: B

9. Acceleration is always in the direction:

A. of the displacement

B. of the initial velocity

C. of the final velocity

D. of the net force

E. opposite to the frictional force

ans: D

10. The term “mass” refers to the same physical concept as:

A. weight

B. inertia

C. force

D. acceleration

C. volume

ans: B

50 Chapter 5: FORCE AND MOTION – I

11. The inertia of a body tends to cause the body to:

A. speed up

B. slow down

C. resist any change in its motion

D. fall toward Earth

E. decelerate due to friction

ans: C

12. A heavy ball is suspended as shown. A quick jerk on the lower string will break that string but a slow pull on the lower string will break the upper string. The first result occurs because:

.............................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................

......... ........ ......... ........ ......... ........ ................ ........upper string

• •••••••• •••••• ••••••••••••

......... ........ ......... ........ ......... ........ ................ ........lower string

A. the force is too small to move the ball

B. action and reaction is operating

C. the ball has inertia

D. air friction holds the ball back

E. the ball has too much energy

ans: C

13. When a certain force is applied to the standard kilogram its acceleration is 5.0 m/s2. When the same force is applied to another object its acceleration is one-fifth as much. The mass of the object is:

A. 0.2 kg

B. 0.5 kg

C. 1.0 kg

D. 5.0 kg

E. 10 kg

ans: D

14. Mass differs from weight in that:

A. all objects have weight but some lack mass

B. weight is a force and mass is not

C. the mass of an object is always more than its weight

D. mass can be expressed only in the metric system

E. there is no difference

ans: B

Chapter 5: FORCE AND MOTION – I 51

15. The mass of a body:

A. is slightly different at different places on Earth

B. is a vector

C. is independent of the free-fall acceleration

D. is the same for all bodies of the same volume

E. can be measured most accurately on a spring scale

ans: C

16. The mass and weight of a body:

A. differ by a factor of 9.8

B. are identical

C. are the same physical quantities expressed in different units

D. are both a direct measure of the inertia of the body

E. have the same ratio as that of any other body placed at that location

ans: E

17. An object placed on an equal-arm balance requires 12 kg to balance it. When placed on a spring scale, the scale reads 12 kg. Everything (balance, scale, set of weights and object) is now transported to the Moon where the free-fall acceleration is one-sixth that on Earth. The new readings of the balance and spring scale (respectively) are:

A. 12 kg, 12 kg

B. 2 kg, 2 kg

C. 12 kg, 2 kg

D. 2 kg, 12 kg

E. 12 kg, 72 kg

ans: C

18. Two objects, one having three times the mass of the other, are dropped from the same height in a vacuum. At the end of their fall, their velocities are equal because:

A. anything falling in vacuum has constant velocity

B. all objects reach the same terminal velocity

C. the acceleration of the larger object is three times greater than that of the smaller object D. the force of gravity is the same for both objects

E. none of the above

ans: E

19. A feather and a lead ball are dropped from rest in vacuum on the Moon. The acceleration of the feather is:

A. more than that of the lead ball

B. the same as that of the lead ball

C. less than that of the lead ball

D. 9.8 m/s2

E. zero since it floats in a vacuum

ans: B

52 Chapter 5: FORCE AND MOTION – I

20. The block shown moves with constant velocity on a horizontal surface. Two of the forces on it are shown. A frictional force exerted by the surface is the only other horizontal force on the block. The frictional force is:

3 N

............................................................. ........... .....................

5 N

..................................................................... ....... .............. ....... .....

A. 0

B. 2 N, leftward C. 2 N, rightward

............................................................................................................................................................................................................................................................

D. slightly more than 2 N, leftward

E. slightly less than 2 N, leftward

ans: B

21. Two forces, one with a magnitude of 3 N and the other with a magnitude of 5 N, are applied to an object. For which orientations of the forces shown in the diagrams is the magnitude of the acceleration of the object the least?

3 N

5 N

............................................................................................... 3 N

5 N

.............................................................. ....... ........ 3 N

............................................................. ........... ....................

A

...................................................................... ....... ............. ...... ......

3 N

B

...................................................................... ....... ............. ...... ...... ................................................... 3 N .....................

C

5 N

...................................................................... ....... ............. ...... ...... 5 N

E

ans: A

.............................................. ....... ............. ....... .....

...................................................................... ....... ............. ....... .....

5 N D

...................................................................... ....... ............. ....... .....

22. A crate rests on a horizontal surface and a woman pulls on it with a 10-N force. Rank the situations shown below according to the magnitude of the normal force exerted by the surface on the crate, least to greatest.

10 N

.............................................. ....... ............. ...... ......

..................................................................................................................................................................................................................

1

A. 1, 2, 3

B. 2, 1, 3

C. 2, 3, 1

D. 1, 3, 2

E. 3, 2, 1

ans: E

10 N

............................................................... ....... .........

.................................................................................................................................................................................................................. 2

............................................................................................. 10 N

.................................................................................................................................................................................................................. 3

Chapter 5: FORCE AND MOTION – I 53

23. A heavy wooden block is dragged by a force Fn along a rough steel plate, as shown in the diagrams for two cases. The magnitude of the applied force Fn is the same for both cases. The normal force in (ii), as compared with the normal force in (i) is:

...................................................................... ........ Fn

.................................................................................................................................................................................................................................

...............................................................................................................................................................................................................................................................................................................................................................................................................

................................................................................................................................................................................................................................

(ii)

A. the same

B. greater

C. less

.......................................... ...... ..... ......... ....... ......Fn

....................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................... (i)

D. less for some angles of the incline and greater for others

E. less or greater, depending on the magnitude of the applied force Fn .

ans: C

24. Equal forces Fn act on isolated bodies A and B. The mass of B is three times that of A. The magnitude of the acceleration of A is:

A. three times that of B

B. 1/3 that of B

C. the same as B

D. nine times that of B

E. 1/9 that of B

ans: A

25. A car travels east at constant velocity. The net force on the car is:

A. east

B. west

C. up

D. down

E. zero

ans: E

26. A constant force of 8.0 N is exerted for 4.0 s on a 16-kg object initially at rest. The change in speed of this object will be:

A. 0.5 m/s

B. 2 m/s

C. 4 m/s

D. 8 m/s

E. 32 m/s

ans: B

54 Chapter 5: FORCE AND MOTION – I

27. A 6-kg object is moving south. A net force of 12 N north on it results in the object having an acceleration of:

A. 2 m/s2, north

B. 2 m/s2, south

C. 6 m/s2, north

D. 18 m/s2, north

E. 18 m/s2, south

ans: A

28. A 9000-N automobile is pushed along a level road by four students who apply a total forward force of 500 N. Neglecting friction, the acceleration of the automobile is:

A. 0.055 m/s2

B. 0.54 m/s2

C. 1.8 m/s2

D. 9.8 m/s2

E. 18 m/s2

ans: B

29. An object rests on a horizontal frictionless surface. A horizontal force of magnitude F is applied. This force produces an acceleration:

A. only if F is larger than the weight of the object

B. only while the object suddenly changes from rest to motion

C. always

D. only if the inertia of the object decreases

E. only if F is increasing

ans: C

30. A 25-kg crate is pushed across a frictionless horizontal floor with a force of 20 N, directed 20◦ below the horizontal. The acceleration of the crate is:

A. 0.27 m/s2

B. 0.75 m/s2

C. 0.80 m/s2

D. 170 m/s2

E. 470 m/s2

ans: B

31. A ball with a weight of 1.5 N is thrown at an angle of 30◦ above the horizontal with an initial speed of 12 m/s. At its highest point, the net force on the ball is:

A. 9.8 N, 30◦ below horizontal

B. zero

C. 9.8 N, up

D. 9.8 N, down

E. 1.5 N, down

ans: E

Chapter 5: FORCE AND MOTION – I 55

32. Two forces are applied to a 5.0-kg crate; one is 6.0 N to the north and the other is 8.0 N to the west. The magnitude of the acceleration of the crate is:

A. 0.50 m/s2

B. 2.0 m/s2

C. 2.8 m/s2

D. 10 m/s2

E. 50 m/s2

ans: B

33. A 400-N steel ball is suspended by a light rope from the ceiling. The tension in the rope is: A. 400 N

B. 800 N

C. zero

D. 200 N

E. 560 N

ans: A

34. A heavy steel ball B is suspended by a cord from a block of wood W. The entire system is dropped through the air. Neglecting air resistance, the tension in the cord is: A. zero

B. the difference in the masses of B and W

C. the difference in the weights of B and W

D. the weight of B

E. none of these

ans: A

35. A circus performer of weight W is walking along a “high wire” as shown. The tension in the wire:

...

.................. .............. ................................................................... ....... ..... ..... ..... ..... ..............

................................................................................... ................. .................................................................................................... .............................................................................................

.............................................................................................................................................................................................

............................................................................................................................................................................................ ..... . ..........................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................

.............................................................................................................................................................................................................................................................

......

......... ........

A. is approximately W

B. is approximately W/2

C. is much less than W

D. is much more than W

E. depends on whether he stands on one foot or two feet ans: D

56 Chapter 5: FORCE AND MOTION – I

36. A 1000-kg elevator is rising and its speed is increasing at 3 m/s2. The tension force of the cable on the elevator is:

A. 6800 N

B. 1000 N

C. 3000 N

D. 9800 N

E. 12800 N

ans: E

∗37. A 5-kg block is suspended by a rope from the ceiling of an elevator as the elevator accelerates downward at 3.0 m/s2. The tension force of the rope on the block is:

A. 15 N, up

B. 34 N, up

C. 34 N, down

D. 64 N, up

E. 64 N, down

ans: B

38. A crane operator lowers a 16, 000-N steel ball with a downward acceleration of 3 m/s2. The tension force of the cable is:

A. 4900 N

B. 11, 000 N

C. 16, 000 N

D. 21, 000 N

E. 48, 000 N

ans: B

39. A 1-N pendulum bob is held at an angle θ from the vertical by a 2-N horizontal force F as shown. The tension in the string supporting the pendulum bob (in newtons) is:

.............................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................

..................................... • •••••• ••••••• ••••••••••••••••

.......................

θ

.............................................................................................. ....... ............. ....... ....Fn

A. cos θ

B. 2/ cos θ

C. √5

D. 1

E. none of these

ans: C

Chapter 5: FORCE AND MOTION – I 57

40. A car moves horizontally with a constant acceleration of 3 m/s2. A ball is suspended by a string from the ceiling of the car. The ball does not swing, being at rest with respect to the car. What angle does the string make with the vertical?

A. 17◦

B. 35◦

C. 52◦

D. 73◦

E. Cannot be found without knowing the length of the string

ans: A

41. A man weighing 700 Nb is in an elevator that is accelerating upward at 4 m/s2. The force exerted on him by the elevator floor is:

A. 71 N

B. 290 N

C. 410 N

D. 700 N

E. 990 N

ans: E

42. You stand on a spring scale on the floor of an elevator. Of the following, the scale shows the highest reading when the elevator:

A. moves upward with increasing speed

B. moves upward with decreasing speed

C. remains stationary

D. moves downward with increasing speed

E. moves downward at constant speed

ans: A

43. You stand on a spring scale on the floor of an elevator. Of the following, the scale shows the highest reading when the elevator:

A. moves downward with increasing speed

B. moves downward with decreasing speed

C. remains stationary

D. moves upward with decreasing speed

E. moves upward at constant speed

ans: B

44. When a 25-kg crate is pushed across a frictionless horizontal floor with a force of 200 N, directed 20◦ below the horizontal, the magnitude of the normal force of the floor on the crate is: A. 25 N

B. 68 N

C. 180 N

D. 250 N

E. 310 N

ans: E

58 Chapter 5: FORCE AND MOTION – I

45. A block slides down a frictionless plane that makes an angle of 30◦ with the horizontal. The acceleration of the block is:

A. 980 cm/s2

B. 566 cm/s2

C. 849 cm/s2

D. zero

E. 490 cm/s2

ans: E

46. A 25-N crate slides down a frictionless incline that is 25◦ above the horizontal. The magnitude of the normal force of the incline on the crate is:

A. 11 N

B. 23 N

C. 25 N

D. 100 N

E. 220 N

ans: B

47. A 25-N crate is held at rest on a frictionless incline by a force that is parallel to the incline. If the incline is 25◦ above the horizontal the magnitude of the applied force is: A. 4.1 N

B. 4.6 N

C. 8.9 N

D. 11 N

E. 23 N

ans: D

48. A 25-N crate is held at rest on a frictionless incline by a force that is parallel to the incline. If the incline is 25◦ above the horizontal the magnitude of the normal force of the incline on the crate is:

A. 4.1 N

B. 4.6 N

C. 8.9 N

D. 11 N

E. 23 N

ans: E

49. A 32-N force, parallel to the incline, is required to push a certain crate at constant velocity up a frictionless incline that is 30◦ above the horizontal. The mass of the crate is: A. 3.3 kg

B. 3.8 kg

C. 5.7 kg

D. 6.5 kg

E. 160 kg

ans: D

Chapter 5: FORCE AND MOTION – I 59

50. A sled is on an icy (frictionless) slope that is 30◦ above the horizontal. When a 40-N force, parallel to the incline and directed up the incline, is applied to the sled, the acceleration of the sled is 2.0 m/s2, down the incline. The mass of the sled is:

A. 3.8 kg

B. 4.1 kg

C. 5.8 kg

D. 6.2 kg

E. 10 kg

ans: E

51. When a 40-N force, parallel to the incline and directed up the incline, is applied to a crate on a frictionless incline that is 30◦ above the horizontal, the acceleration of the crate is 2.0 m/s2, up the incline. The mass of the crate is:

A. 3.8 kg

B. 4.1 kg

C. 5.8 kg

D. 6.2 kg

E. 10 kg

ans: C

52. The “reaction” force does not cancel the “action” force because:

A. the action force is greater than the reaction force

B. they are on different bodies

C. they are in the same direction

D. the reaction force exists only after the action force is removed

E. the reaction force is greater than the action force

ans: B

53. A book rests on a table, exerting a downward force on the table. The reaction to this force is: A. the force of Earth on the book

B. the force of the table on the book

C. the force of Earth on the table

D. the force of the book on Earth

E. the inertia of the book

ans: B

54. A lead block is suspended from your hand by a string. The reaction to the force of gravity on the block is the force exerted by:

A. the string on the block

B. the block on the string

C. the string on the hand

D. the hand on the string

E. the block on Earth

ans: E

60 Chapter 5: FORCE AND MOTION – I

55. A 5-kg concrete block is lowered with a downward acceleration of 2.8 m/s2 by means of a rope. The force of the block on the rope is:

A. 14 N, up

B. 14 N, down

C. 35 N, up

D. 35 N, down

E. 49 N, up

ans: D

56. A 90-kg man stands in an elevator that is moving up at a constant speed of 5.0 m/s. The force exerted by him on the floor is about:

A. zero

B. 90 N

C. 880 N

D. 450 N

E. 49 N

ans: C

57. A 90-kg man stands in an elevator that has a downward acceleration of 1.4 m/s2. The force exerted by him on the floor is about:

A. zero

B. 90 N

C. 760 N

D. 880 N

E. 1010 N

ans: C

58. A 5-kg concrete block is lowered with a downward acceleration of 2.8 m/s2 by means of a rope. The force of the block on Earth is:

A. 14 N, up

B. 14 N, down

C. 35 N, up

D. 35 N, down

E. 49 N, up

ans: E

Chapter 5: FORCE AND MOTION – I 61

59. Two blocks are connected by a string and pulley as shown. Assuming that the string and pulley are massless, the magnitude of the acceleration of each block is:

.........................................................................................................................................................................................................................................................................................................................................................................................................................................................

•

....................................... ...... .......... .................... ...... .... ......................................................................................................................................................

•

90 g

110 g

A. 0.049 m/s2

B. 0.020 m/s2

C. 0.0098 m/s2

D. 0.54 m/s2

E. 0.98 m/s2

ans: E

60. A 70-N block and a 35-N block are connected by a string as shown. If the pulley is massless and the surface is frictionless, the magnitude of the acceleration of the 35-N block is:

................................ ...... ........................... .... ............................. 70 N .............................................•..................................................... pulley

..................

................................................................................................................................................................................................................................................................................................................................................................................................................

.........................

.........................

.........................

.........................

.........................

.........................

.........................

.........................

.........................

.........................

A. 1.6 m/s2

B. 3.3 m/s2

C. 4.9 m/s2

D. 6.7 m/s2

E. 9.8 m/s2

ans: B

62 Chapter 5: FORCE AND MOTION – I

35 N

61. A 13-N weight and a 12-N weight are connected by a massless string over a massless, frictionless pulley. The 13-N weight has a downward acceleration with magnitude equal to that of a freely falling body times:

A. 1

B. 1/12

C. 1/13

D. 1/25

E. 13/25

ans: D

62. A massless rope passes over a massless pulley suspended from the ceiling. A 4-kg block is attached to one end and a 5-kg block is attached to the other end. The acceleration of the 5-kg block is:

A. g/4

B. 5g/9

C. 4g/9

D. g/5

E. g/9

ans: E

63. Two blocks, weighing 250 N and 350 N, respectively, are connected by a string that passes over a massless pulley as shown. The tension in the string is:

..............................................................................................................................................................................................................................................................................................................................................................................................................................................................................

•

................................... ... ...... .......... .................... ...... .... ......................................................................................................................................................

•

250 N

350 N

A. 210 N

B. 290 N

C. 410 N

D. 500 N

E. 4900 N

ans: B

Chapter 5: FORCE AND MOTION – I 63

64. Three books (X, Y, and Z) rest on a table. The weight of each book is indicated. The net force acting on book Y is:

X 4 N

Y 5 N

Z 10 N

..........................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................

A. 4 N down

B. 5 N up

C. 9 N down

D. zero

E. none of these

ans: D

65. Three books (X, Y, and Z) rest on a table. The weight of each book is indicated. The force of book Z on book Y is:

X 4 N

Y 5 N

Z 10 N

..........................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................

A. 0

B. 5 N

C. 9 N

D. 14 N

E. 19 N

ans: C

66. Three blocks (A,B,C), each having mass M, are connected by strings as shown. Block C is pulled to the right by a force Fn that causes the entire system to accelerate. Neglecting friction, the net force acting on block B is:

A B C .............................................. ...... ............. ....... .... Fn

.............................................................................................................................................................................................................................................................................................................................................................................................................................................

A. zero

B. F / n 3

C. F / n 2

D. 2F / n 3

E. Fn

ans: B

64 Chapter 5: FORCE AND MOTION – I

67. Two blocks with masses m and M are pushed along a horizontal frictionless surface by a horizontal applied force Fn as shown. The magnitude of the force of either of these blocks on the other is:

Fn

M m ............................................... ....... ............. ...... .....

........................................................................................................................................................................................................................................................................

A. mF/(m + M)

B. mF/M

C. mF/(M − m)

D. MF/(M + m)

E. MF/m

ans: A

68. Two blocks (A and B) are in contact on a horizontal frictionless surface. A 36-N constant force is applied to A as shown. The magnitude of the force of A on B is:

mA = 4.0 kg

36 N

B .................................................................... A ....... .......

mB = 20 kg

.....................................................................................................................................................................................................................................................................................................................................

A. 1.5 N

B. 6.0 N

C. 29 N

D. 30 N

E. 36 N

ans: D

69. A short 10-g string is used to pull a 50-g toy across a frictionless horizontal surface. If a 3.0 × 10−2-N force is applied horizontally to the free end, the force of the string on the toy, at the other end, is:

A. 0.15 N

B. 6.0 × 10−3 N

C. 2.5 × 10−2 N

D. 3.0 × 10−2 N

E. 3.5 × 10−2 N

ans: C

Chapter 5: FORCE AND MOTION – I 65

Chapter 6: FORCE AND MOTION – II

1. A brick slides on a horizontal surface. Which of the following will increase the magnitude of the frictional force on it?

A. Putting a second brick on top

B. Decreasing the surface area of contact

C. Increasing the surface area of contact

D. Decreasing the mass of the brick

E. None of the above

ans: A

2. The coefficient of kinetic friction:

A. is in the direction of the frictional force

B. is in the direction of the normal force

C. is the ratio of force to area

D. can have units of newtons

E. is none of the above

ans: E

3. When the brakes of an automobile are applied, the road exerts the greatest retarding force: A. while the wheels are sliding

B. just before the wheels start to slide

C. when the automobile is going fastest

D. when the acceleration is least

E. at the instant when the speed begins to change

ans: B

4. A forward horizontal force of 12 N is used to pull a 240-N crate at constant velocity across a horizontal floor. The coefficient of friction is:

A. 0.5

B. 0.05

C. 2

D. 0.2

E. 20

ans: B

5. The speed of a 4.0-N hockey puck, sliding across a level ice surface, decreases at the rate of 0.61 m/s2. The coefficient of kinetic friction between the puck and ice is:

A. 0.062

B. 0.41

C. 0.62

D. 1.2

E. 9.8

ans: A

66 Chapter 6: FORCE AND MOTION – II

6. A crate rests on a horizontal surface and a woman pulls on it with a 10-N force. No matter what the orientation of the force, the crate does not move. Rank the situations shown below according to the magnitude of the frictional force of the surface on the crate, least to greatest.

............................................................................................... 10 N

..................................................................................................................................................................................................................

3

A. 1, 2, 3

B. 2, 1, 3

C. 2, 3, 1

D. 1, 3, 2

E. 3, 2, 1

ans: E

10 N

............................................... ....... ............. ....... ....

.................................................................................................................................................................................................................. 1

10 N

.............................................................. ....... .........

.................................................................................................................................................................................................................. 2

7. A crate with a weight of 50 N rests on a horizontal surface. A person pulls horizontally on it with a force of 10 N and it does not move. To start it moving, a second person pulls vertically upward on the crate. If the coefficient of static friction is 0.4, what is the smallest vertical force for which the crate moves?

10 N ...............................................................................................

......................................................... ....... .............. ....... .....

............................................................................................................................................................................................................................................................

A. 4 N

B. 10 N

C. 14 N

D. 25 N

E. 35 N

ans: D

8. A 40-N crate rests on a rough horizontal floor. A 12-N horizontal force is then applied to it. If the coefficients of friction are µs = 0.5 and µk = 0.4, the magnitude of the frictional force on the crate is:

A. 8 N

B. 12 N

C. 16 N

D. 20 N

E. 40 N

ans: B

Chapter 6: FORCE AND MOTION – II 67

9. A 24-N horizontal force is applied to a 40-N block initially at rest on a rough horizontal surface. If the coefficients of friction are µs = 0.5 and µk = 0.4, the magnitude of the frictional force on the block is:

A. 8 N

B. 12 N

C. 16 N

D. 20 N

E. 400 N

ans: C

10. A horizontal shove of at least 200 N is required to start moving a 800-N crate initially at rest on a horizontal floor. The coefficient of static friction is:

A. 0.25

B. 0.125

C. 0.50

D. 4.00

E. none of these

ans: A

11. A force Fn (larger than the largest possible force of static friction) is applied to the left to an object moving to the right on a horizontal surface. Then:

A. the object must be moving at constant speed

B. Fn and the friction force act in opposite directions

C. the object must be slowing down

D. the object must be speeding up

E. the object must come to rest and remain at rest

ans: C

12. A bureau rests on a rough horizontal surface (µs = 0.50, µk = 0.40). A constant horizontal force, just sufficient to start the bureau in motion, is then applied. The acceleration of the bureau is:

A. 0

B. 0.98 m/s2

C. 3.3 m/s2

D. 4.5 m/s2

E. 8.9 m/s2

ans: B

13. A car is traveling at 15 m/s on a horizontal road. The brakes are applied and the car skids to a stop in 4.0 s. The coefficient of kinetic friction between the tires and road is: A. 0.38

B. 0.69

C. 0.76

D. 0.92

E. 1.11

ans: A

68 Chapter 6: FORCE AND MOTION – II

14. A boy pulls a wooden box along a rough horizontal floor at constant speed by means of a force Pn as shown. In the diagram f is the magnitude of the force of friction, N is the magnitude of the normal force, and Fg is the magnitude of the force of gravity. Which of the following must be true?

................................................................................................................. N

f ....................

............................................................................... ...........

........................................................ ....... ............... ....... .....P

Fng: force of gravity nf: frictional force Nn : normal force

..................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................

................................................................................................................Fg

A. P = f and N = Fg

B. P = f and N>Fg

C. P >f and N<Fg

D. P >f and N = Fg

E. none of these

ans: A

15. A boy pulls a wooden box along a rough horizontal floor at constant speed by means of a force Pn as shown. In the diagram f is the magnitude of the force of friction, N is the magnitude of the normal force, and Fg is the magnitude of the force of gravity. Which of the following must be true?

............................................................................................... N

f .....................

................................................................................................. ...........

................................................................................................................... ......... P θ

Fng: force of gravity nf: frictional force Nn : normal force

..................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................

.................................................................................................................................Fg

A. P = f and N = Fg

B. P = f and N>Fg

C. P >f and N<Fg

D. P >f and N = Fg

E. none of these

ans: C

Chapter 6: FORCE AND MOTION – II 69

16. A 400-N block is dragged along a horizontal surface by an applied force Fn as shown. The coef ficient of kinetic friction is µk = 0.4 and the block moves at constant velocity. The magnitude of Fn is:

................................................................................................................................................ .......... .. F

(3/5)F

(4/5)F

..................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................

A. 100 N

B. 150 N

C. 200 N

D. 290 N

E. 400 Nb

ans: B

17. A block of mass m is pulled at constant velocity along a rough horizontal floor by an applied force Tn as shown. The magnitude of the frictional force is:

................................................................................................................................................ .......... ... T

.............................θ

.....................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................

A. T cos θ

B. T sin θ

C. zero

D. mg

E. mg cos θ

ans: A

70 Chapter 6: FORCE AND MOTION – II

18. A block of mass m is pulled along a rough horizontal floor by an applied force Tn as shown. The vertical component of the force exerted on the block by the floor is:

................................................................................................................................................ .......... ... T

.............................θ

.....................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................

A. mg

B. mg − T cos θ

C. mg + T cos θ

D. mg − T sin θ

E. mg + T sin θ

ans: D

19. A 12-kg crate rests on a horizontal surface and a boy pulls on it with a force that is 30◦ below the horizontal. If the coefficient of static friction is 0.40, the minimum magnitude force he needs to start the crate moving is:

A. 44 N

B. 47 N

C. 54 N

D. 56 N

E. 71 N

ans: E

20. A crate resting on a rough horizontal floor is to be moved horizontally. The coefficient of static friction is 0.40. To start the crate moving with the weakest possible applied force, in what direction should the force be applied?

A. Horizontal

B. 24◦ below the horizontal

C. 22◦ above the horizontal

D. 24◦ above the horizontal

E. 66◦ below the horizontal

ans: C

21. A 50-N force is applied to a crate on a horizontal rough floor, causing it to move horizontally. If the coefficient of kinetic friction is 0.50, in what direction should the force be applied to obtain the greatest acceleration?

A. Horizontal

B. 60◦ above the horizontal

C. 30◦ above the horizontal

D. 27◦ above the horizontal

E. 30◦ below the horizontal

ans: D

Chapter 6: FORCE AND MOTION – II 71

22. A professor holds an eraser against a vertical chalkboard by pushing horizontally on it. He pushes with a force that is much greater than is required to hold the eraser. The force of friction exerted by the board on the eraser increases if he:

A. pushes with slightly greater force

B. pushes with slightly less force

C. stops pushing

D. pushes so his force is slightly downward but has the same magnitude

E. pushes so his force is slightly upward but has the same magnitude

ans: D

23. A horizontal force of 12 N pushes a 0.5-kg book against a vertical wall. The book is initially at rest. If the coefficients of friction are µs = 0.6 and µk = 0.8 which of the following is true? A. The magnitude of the frictional force is 4.9 N

B. The magnitude of the frictional force is 7.2 N

C. The normal force is 4.9 N

D. The book will start moving and accelerate

E. If started moving downward, the book will decelerate

ans: A

24. A horizontal force of 5.0 N pushes a 0.50-kg book against a vertical wall. The book is initially at rest. If the coefficients of friction are µs = 0.6 and µk = 0.80, the magnitude of the frictional force is:

A. 0

B. 4.9 N

C. 3.0 N

D. 5.0 N

E. 4.0 N

ans: E

25. A horizontal force of 12 N pushes a 0.50-kg book against a vertical wall. The book is initially at rest. If µs = 0.6 and µk = 0.80, the acceleration of the book in m/s2 is:

A. 0

B. 9.4 m/s2

C. 9.8 m/s2

D. 14.4 m/s2

E. 19.2 m/s2

ans: A

26. A horizontal force of 5.0 N pushes a 0.50-kg block against a vertical wall. The block is initially at rest. If µs = 0.60 and µk = 0.80, the acceleration of the block in m/s2 is: A. 0

B. 1.8

C. 6.0

D. 8.0

E. 9.8

ans: B

72 Chapter 6: FORCE AND MOTION – II

27. A heavy wooden block is dragged by a force Fn along a rough steel plate, as shown below for two possible situations. The magnitude of Fn is the same for the two situations. The magnitude of the frictional force in (ii), as compared with that in (i) is:

........................................................................ .......... Fn

.................................................................................................................................................................................................................................

.............................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................

................................................................................................................................................................................................................................

(ii)

A. the same

B. greater

C. less

.......................................... ....... ............. ....... .....Fn

..................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................... (i)

D. less for some angles and greater for others

E. can be less or greater, depending on the magnitude of the applied force. ans: C

28. A block is first placed on its long side and then on its short side on the same inclined plane, as shown. The block slides down the plane on its short side but remains at rest on its long side. A possible explanation is:

........................................θ .......................................................................................................................m..........................................................................................................

.............................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................

................................................................................................................................................................................................................................

v

(ii)

A. the short side is smoother

........................................θ ........................................................................................................................................................................................................................................................................................

............................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................. ................................................................................................................................................................................................................................

m

..... ...... .... ...... ..... ...... ..... ...... ..................

.................

(ii)

B. the frictional force is less because the contact area is less

C. the center of gravity is higher in the second case

D. the normal force is less in the second case

E. the force of gravity is more nearly down the plane in the second case

ans: A

29. A box rests on a rough board 10 meters long. When one end of the board is slowly raised to a height of 6 meters above the other end, the box begins to slide. The coefficient of static friction is:

A. 0.8

B. 0.25

C. 0.4

D. 0.6

E. 0.75

ans: E

Chapter 6: FORCE AND MOTION – II 73

30. A block is placed on a rough wooden plane. It is found that when the plane is tilted 30◦ to the horizontal, the block will slide down at constant speed. The coefficient of kinetic friction of the block with the plane is:

A. 0.500

B. 0.577

C. 1.73

D. 0.866

E. 4.90

ans: B

31. A crate is sliding down an incline that is 35◦ above the horizontal. If the coefficient of kinetic friction is 0.40, the acceleration of the crate is:

A. 0

B. 2.4 m/s2

C. 5.8 m/s2

D. 8.8 m/s2

E. 10.3 m/s2

ans: B

32. A 5.0-kg crate is resting on a horizontal plank. The coefficient of static friction is 0.50 and the coefficient of kinetic friction is 0.40. After one end of the plank is raised so the plank makes an angle of 25◦ with the horizontal, the force of friction is:

A. 0

B. 18 N

C. 21 N

D. 22 N

E. 44 N

ans: C

33. A 5.0-kg crate is resting on a horizontal plank. The coefficient of static friction is 0.50 and the coefficient of kinetic friction is 0.40. After one end of the plank is raised so the plank makes an angle of 30◦ with the horizontal, the force of friction is:

A. 0

B. 18 N

C. 21 N

D. 22 N

E. 44 N

ans: B

74 Chapter 6: FORCE AND MOTION – II

34. A 5.0-kg crate is on an incline that makes an angle of 30◦ with the horizontal. If the coefficient of static friction is 0.50, the minimum force that can be applied parallel to the plane to hold the crate at rest is:

A. 0

B. 3.3 N

C. 30 N

D. 46 N

E. 55 N

ans: B

35. A 5.0-kg crate is on an incline that makes an angle of 30◦ with the horizontal. If the coefficient of static friction is 0.5, the maximum force that can be applied parallel to the plane without moving the crate is:

A. 0

B. 3.3 N

C. 30 N

D. 46 N

E. 55 N

ans: D

36. Block A, with mass mA, is initially at rest on a horizontal floor. Block B, with mass mB, is initially at rest on the horizontal top surface of A. The coefficient of static friction between the two blocks is µs. Block A is pulled with a horizontal force. It begins to slide out from under B if the force is greater than:

A. mAg

B. mBg

C. µsmAg

D. µsmBg

E. µs(mA + mB)g

ans: E

37. The system shown remains at rest. Each block weighs 20 N. The force of friction on the upper block is:

............................................................................................................................................................................................................................................................................................................................................................................................. ... ...... ......................... .... ............................................

W = 20 N

a = 3m

b = 4m

A. 4 N

B. 8 N

C. 12 N

D. 16 N

E. 20 N

ans: B

...................................................................................................................

.................................................................................................................................................................................................................................................................................................................................................................................................................................................................................... ..............................................................................................................................................................................................................................................................................................

W W

a

b

Chapter 6: FORCE AND MOTION – II 75

38. Block A, with a mass of 50 kg, rests on a horizontal table top. The coefficient of static friction is 0.40. A horizontal string is attached to A and passes over a massless, frictionless pulley as shown. The smallest mass mB of block B, attached to the dangling end, that will start A moving when it is attached to the other end of the string is:

.............................. .... ........ ....................... ..... .............................. A .............................................•.................................................... pulley

..................

................................................................................................................................................................................................................................................................................................................................................................................................................

.........................

.........................

.........................

.........................

B

.........................

.........................

.........................

.........................

.........................

.........................

A. 20 kg

B. 30 kg

C. 40 kg

D. 50 kg

E. 70 kg

ans: A

39. Block A, with a mass of 10 kg, rests on a 35◦ incline. The coefficient of static friction is 0.40. An attached string is parallel to the incline and passes over a massless, frictionless pulley at the top. The largest mass mB of block B, attached to the dangling end, for which A begins to slide down the incline is:

.................................................................................................................................................................................................................................................................................................................................................................................................. ...... ........................... ..............................................

...................................................................................................................

...................................................................................................................................................................................................................................................................................................................................................................................................................................................................................

..............................................................................................................................................................................................................................................................................................

AB

A. 2.5 kg

B. 3.5 kg

C. 5.9 kg

D. 9.0 kg

E. 10.5 kg

ans: A

76 Chapter 6: FORCE AND MOTION – II

40. Block A, with a mass of 10 kg, rests on a 35◦ incline. The coefficient of static friction is 0.40. An attached string is parallel to the incline and passes over a massless, frictionless pulley at the top. The largest mass mB, attached to the dangling end, for which A remains at rest is:

................................................................................................................................................................................................................................................................................................................................................................................................... ...... ........................ .... .........................................

...................................................................................................................

...................................................................................................................................................................................................................................................................................................................................................................................................................................................................................

..............................................................................................................................................................................................................................................................................................

AB

A. 2.5 kg

B. 3.5 kg

C. 5.9 kg

D. 9.0 kg

E. 10.5 kg

ans: D

41. Block A, with a mass of 10 kg, rests on a 30◦ incline. The coefficient of kinetic friction is 0.20. The attached string is parallel to the incline and passes over a massless, frictionless pulley at the top. Block B, with a mass of 8.0 kg, is attached to the dangling end of the string. The acceleration of B is:

.................................................................................................................................................................................................................................................................................................................................................................................................. ..... ............ ............. ...... ...........................................

...................................................................................................................

....................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................

..............................................................................................................................................................................................................................................................................................

AB

A. 0.69 m/s2, up the plane

B. 0.69 m/s2, down the plane

C. 2.6 m/s2, up the plane

D. 2.6 m/s2, down the plane

E. 0

ans: B

Chapter 6: FORCE AND MOTION – II 77

42. Block A, with a mass of 10 kg, rests on a 30◦ incline. The coefficient of kinetic friction is 0.20. The attached string is parallel to the incline and passes over a massless, frictionless pulley at the top. Block B, with a mass of 3.0 kg, is attached to the dangling end of the string. The acceleration of B is:

.................................................................................................................................................................................................................................................................................................................................................................................................. ..... .......... ................ ...... ............................................

...................................................................................................................

....................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................

..............................................................................................................................................................................................................................................................................................

AB

A. 0.20 m/s2, up

B. 0.20 m/s2, down

C. 2.8 m/s2, up

D. 2.8 m/s2, down

E. 0

ans: A

43. A 1000-kg airplane moves in straight flight at constant speed. The force of air friction is 1800 N. The net force on the plane is:

A. zero

B. 11800 N

C. 1800 N

D. 9800 N

E. none of these

ans: A

44. Why do raindrops fall with constant speed during the later stages of their descent? A. The gravitational force is the same for all drops

B. Air resistance just balances the force of gravity

C. The drops all fall from the same height

D. The force of gravity is negligible for objects as small as raindrops

E. Gravity cannot increase the speed of a falling object to more than 9.8 m/s ans: B

45. A ball is thrown downward from the edge of a cliff with an initial speed that is three times the terminal speed. Initially its acceleration is

A. upward and greater than g

B. upward and less than g

C. downward and greater than g

D. downward and less than g

E. downward and equal to g

ans: A

78 Chapter 6: FORCE AND MOTION – II

46. A ball is thrown upward into the air with a speed that is greater than terminal speed. On the way up it slows down and, after its speed equals the terminal speed but before it gets to the top of its trajectory:

A. its speed is constant

B. it continues to slow down

C. it speeds up

D. its motion becomes jerky

E. none of the above

ans: B

47. A ball is thrown upward into the air with a speed that is greater than terminal speed. It lands at the place where it was thrown. During its flight the force of air resistance is the greatest: A. just after it is thrown

B. halfway up

C. at the top of its trajectory

D. halfway down

E. just before it lands.

ans: A

48. Uniform circular motion is the direct consequence of:

A. Newton’s third law

B. a force that is always tangent to the path

C. an acceleration tangent to the path

D. a force of constant magnitude that is always directed away from the same fixed point E. a force of constant magnitude that is always directed toward the same fixed point ans: E

49. An object moving in a circle at constant speed:

A. must have only one force acting on it

B. is not accelerating

C. is held to its path by centrifugal force

D. has an acceleration of constant magnitude

E. has an acceleration that is tangent to the circle

ans: D

50. An object of mass m and another object of mass 2m are each forced to move along a circle of radius 1.0 m at a constant speed of 1.0 m/s. The magnitudes of their accelerations are: A. equal

B. in the ratio of √2: 1

C. in the ratio of 2 : 1

D. in the ratio of 4 : 1

E. zero

ans: A

Chapter 6: FORCE AND MOTION – II 79

51. The magnitude of the force required to cause a 0.04-kg object to move at 0.6 m/s in a circle of radius 1.0 m is:

A. 2.4 × 10−2 N

B. 1.4 × 10−2 N

C. 1.4π × 10−2 N

D. 2.4π2 × 10−2 N

E. 3.13 N

ans: B

52. A 0.2-kg stone is attached to a string and swung in a circle of radius 0.6 m on a horizontal and frictionless surface. If the stone makes 150 revolutions per minute, the tension force of the string on the stone is:

A. 0.03 N

B. 0.2 N

C. 0.9 N

D. 1.96 N

E. 30 N

ans: E

53. Which of the following five graphs is correct for a particle moving in a circle of radius r at a constant speed of 10 m/s?

a

...........................................

r

A

a

............................................................r B

a

................................................................r C

a

................................................................ r

E

ans: E

...............................................................r D

a

54. An object moves around a circle. If the radius is doubled keeping the speed the same then the magnitude of the centripetal force must be:

A. twice as great

B. half as great

C. four times as great

D. one-fourth as great

E. the same

ans: B

80 Chapter 6: FORCE AND MOTION – II