AP PHYSICS REVIEW SHEET Topics covered

Unit 1: Motion I – Constant Velocity

Big Idea 3 – Constant Velocity in one dimension, vectors and multiple representations Learning Objectives: 3.A.1.1, 3.A.1.2, 3.A.1.3

Unit 2: Motion II – Constant Acceleration [

Big Idea 3 – Constant acceleration in one dimension, vectors and multiple representations Learning Objectives: 3.A.1.1, 3.A.1.2, 3.A.1.3, 4.A.2.1, 4.A.2.3

<u>Unit 3: Motion III – 2-d Motion (Projectiles; Rotational Kinematics)</u> Big Ideas 2, 3 – Kinematics in two-dimensions: projectiles, applying representations of kinematics to rotational motion

Learning Objectives: 2.B.1.1, 3.A.1.1, 3.A.1.2, 3.A.1.3, 4.A.2.1, 4.A.2.3

Unit 4: Interactions I – Balanced Forces

Big Ideas 1, 2, 3, 4 – The force concept, Newton's First and Third Laws, modeling systems where Σ F = 0

Learning Objectives: 3.A.1.1, 3.A.1.2, 3.A.1.3, 3.A.2.1, 3.A.3.A, 3.C.4.1, 3.C.4.2, 3.A.4.1, 3.A.4.3

Unit 5: Interactions II – Unbalanced Forces

Big Ideas 1, 2, 3, 4 – Newton's Second Law, modeling systems where Σ F≠ 0 Learning Objectives: 1.C.1.1, 1.C.3.1, 3.B.1.1, 3.B.1.2, 3.B.1.3, 3.B.2.1, 4.A.1.1, 4.A.2.2, 4.A.3.1, 4.A.3.2

<u>Unit 6: Interactions III - Dynamics of Circular Motion; Gravitation</u> Big Ideas 1, 2, 3, 4 – Centripetal acceleration and circular motion, universal gravitation, circular orbits Learning Objectives: 1.C.3.1, 2.B.1.1, 2.B.2.1, 2.B.2.2, 3.C.1.1, 3.C.1.2, 3.G.1.1, 4.A.2.2

Multiple Choice Questions

1) In the product $A \cdot B \cdot C$, A has 5 significant figures, B has 2 significant figures, and C has 3 significant figures. How many significant figures does the product have?

A) 2 B) 3 C) 4 D) 5 E) 10 Answer:

2) In the quotient $AB \cdot C$, A has 5 significant figures, B has 2 significant figures, and C has 3 significant figures. How many significant figures does the quotient have? A) 2

B) 3

C) 4

D) 0

E) 1

Answer:

3) How many significant figures are in the number 0.0037010?

A) four

B) five

C) six

D) seven

E) eight

Answer:

4) How many significant figures are in the number 0.010?

A) four

B) three

C) two

D) one

Answer:

5) What is the product of 12.56 and 2.12 expressed to the correct number of significant figures?

A) 27

B) 26.6

C) 26.23

D) 26.627

6) What is the quotient of 2.43 ÷ 4.561 expressed to the correct number of significant figures??
A) 5.3278 × 10-1
B) 5.328 × 10-1
C) 5.33 × 10-1
D) 5.3 × 10-1
Answer:

7) What is 0.674 /0.74 expressed to the correct number of significant figures?
A) 0.91
B) 0.911
C) 0.9108
D) 0.9
Answer:

8) Consider a deer that runs from point A to point B. The distance the deer runs can be greater than the magnitude of its displacement, but the magnitude of the displacement can never be greater than the distance it runs.

A) True B) False Answer:

9) Which of the following quantities has units of a displacement? (There could be more than one correct choice.)
A) 32 ft/s2 vertically downward
B) 40 km southwest
C) 9.8 m/s2
D) -120 m/s
E) 186,000 mi
Answer:

10) Suppose that an object travels from one point in space to another. Make a comparison between the magnitude of the displacement and the distance traveled by this object.A) The displacement is either greater than or equal to the distance traveled.

B) The displacement is always equal to the distance traveled.

C) The displacement is either less than or equal to the distance traveled.

D) The displacement can be either greater than, smaller than, or equal to the distance traveled.

11) Consider a car that travels between points A and B. The car's average speed can be greater than the magnitude of its average velocity, but the magnitude of its average velocity can never be greater than its average speed.

A) True B) False Answer:

12) Which of the following quantities has units of a velocity? (There could be more than one correct choice.)
A) 40 km southwest
B) -120 m/s
C) 9.8 m/s2 downward
D) 186,000 mi
E) 9.8 m/s downward
Answer:

13) When is the average velocity of an object equal to the instantaneous velocity?
A) only when the velocity is increasing at a constant rate
B) only when the velocity is decreasing at a constant rate
C) when the velocity is constant
D) always
E) never
Answer:

14) You drive 6.0 km at 50 km/h and then another 6.0 km at 90 km/h. Your average speed over the12 km drive will be
A) greater than 70 km/h.
B) equal to 70 km/h.
C) less than 70 km/h.
D) exactly 38 km/h.
E) It cannot be determined from the information given because we must also know directions traveled.
Answer:

15) If the velocity of an object is zero at some point, then its acceleration must also be zero at that point.A) TrueB) FalseAnswer:

16) Which of the following situations is impossible?

A) An object has velocity directed east and acceleration directed west.

B) An object has velocity directed east and acceleration directed east.

C) An object has zero velocity but non-zero acceleration.

D) An object has constant non-zero acceleration and changing velocity.

E) An object

17) The motions of a car and a truck along a straight road are represented by the velocity -time graphs in the figure. The two vehicles are initially alongside each other at time t = 0. At time T, what is true of the *distances* traveled by the vehicles since time t = 0?



A) They will have traveled the same distance.

B) The truck will not have moved.

C) The car will have travelled further than the truck.

D) The truck will have travelled further than the car.

Answer:

18) Which of the following graphs represent an object at rest? (There could be more than one correct choice.)







(e)



A) graph a B) graph b C) graph c D) graph d E) graph e



19) Which of the following graphs represent an object having zero acceleration?

D) graphs b and c E) graphs c and d

Answer:

20) The figure shows a graph of the position x of two cars, C and D, as a function of time t. According to this graph, which statements about these cars must be true? (There could be more than one correct choice.)



A) The magnitude of the acceleration of car C is greater than the magnitude of the acceleration of car D.

B) The magnitude of the acceleration of car C is less than the magnitude of the acceleration of car D.

C) At time t = 10 s, both cars have the same velocity.

D) Both cars have the same acceleration.

E) The cars meet at time t = 10 s.

Answer:

21) The graph in the figure shows the position of an object as a function of time. The letters H-L represent particular moments of time.



(a) At which moment in time is the speed of the object the greatest?

(b) At which moment in time is the speed of the object equal to zero?

Answer: (a) (b)

22) A child standing on a bridge throws a rock straight down. The rock leaves the child's hand at time t = 0 s. If we take upward as the positive direction, which of the graphs shown below best represents the velocity of the stone as a function of time?



23) A child standing on a bridge throws a rock straight down. The rock leaves the child's hand at time t = 0 s. If we take upward as the positive direction, which of the graphs shown below best represents the acceleration of the stone as a function of time? A)



Answer:

24) The graph in the figure shows the position of a particle as it travels along the x-axis. At what value of t is the speed of the particle equal to 0 m/s?



A) 0 s B) 1 s C) 2 s D) 3 s E) 4 s Answer:

25) If a vector pointing upward has a positive magnitude, a vector pointing downward has a negative magnitude.

A) True B) False

Answer:

26) If a vector's components are all negative, then the magnitude of the vector is negative.

A) True

B) False

Answer:

27) The magnitude of a vector can *never* be less than the magnitude of any of its components. A) True

B) False

Answer:

28) The magnitude of a vector an only zero if *all* of its components are zero.

A) True B) False

Answer:

29) If a vector **A** has components Ax < 0, and Ay > 0, then the angle that this vector makes with the positive *x*-axis must be in the range

A) 0° to 90° B) 90° to 180° C) 180° to 270°

D) 270° to 360°

E) It cannot be determined without additional information.

Answer:

30) If a vector A has components Ax < 0, and Ay < 0, then the angle that this vector makes with the positive x-axis must be in the range
A) 0° to 90°
B) 90° to 180°
C) 180° to 270°
D) 270° to 360°
E) cannot be determined without additional information

Answer:

31) If a vector A has components Ax > 0, and Ay < 0, then the angle that this vector makes with the positive x-axis must be in the range
A) 0° to 90°
B) 90° to 180°
C) 180° to 270°
D) 270° to 360°
E) cannot be determined without additional information
Answer:

32) The eastward component of vector **A**is equal to the westward component of vector **B** and their northward components are equal. Which one of the following statements must be correct for these two vectors?

A) Vector **A** is parallel to vector **B**.

B) Vector ${f A}$ is antiparallel (in the opposite direction) to vector ${f B}$.

C) Vector A must be perpendicular to vector B .

D) The magnitude of vector ${\bf A}$ must be equal to the magnitude of vector ${\bf B}$.

E) The angle between vector **A** and vector **B** must be 90°.

Answer:

33) Vector **A** is along the +x-axis and vector **B** is along the +y-axis. Which one of the following statements is correct with respect to these vectors?

A) The x component of vector **A** is equal to the x component of vector **B**.

B) The y component of vector **A** is equal to the y component of vector **B**.

C) The *x* component of vector **A** is equal to the *y* component of vector **B**.

D) The y component of vector ${\bf A}$ is equal to the x component of vector ${\bf B}$. Answer:

34) Shown below are the velocity and acceleration vectors for an object in several different types of

motion. In which case is the object slowing down and turning to its right?



35) Two blocks, A and B, are being pulled to the right along a horizontal surface by a horizontal 100-N pull, as shown in the figure. Both of them are moving together at a constant velocity of 2.0 m/s to the right, and both weigh the same.



Which of the figures below shows a correct free-body diagram of the horizontal forces acting on the upper block, A?



36) Three boxes are pulled along a horizontal frictionless floor by a constant horizontal pull *P*. The

boxes are connected by very light horizontal strings having tensions *T*1 and *T*2 as shown in the figure. Which of the following statements about the tensions is correct? (There could be more than one correct choice.)



A) T1 = P B) T2 = P C) T1 + T2 = P D) T2 > T1 E) T1 > T2 Answer:

37) Two boxes are connected to each other by a string as shown in the figure. The 10-N box slides without friction on the horizontal table surface. The pulley is ideal and the string has negligible mass. What is true about the tension T in the string?



A) T = 10 N B) T = 20 N C) T = 30 N D) T < 30 N E) T > 30 N Answer: 38) Two objects of unequal masses, Mand m (M > m), are connected by a very light cord passing over an ideal pulley of negligible mass. When released, the system accelerates, and friction is negligible.



Which one of the following free-body diagrams most realistically represents the forces acting on the two objects in the moving system?







Answer: C

39) A cat leaps to try to catch a bird. If the cat's jump was at 60 ° off the ground and its initial velocity was 2.74 m/s, what is the highest point of its trajectory, neglecting air resistance?
A) 0.29 m
B) 0.58 m
C) 10.96 m
D) 0.19 m

40) The figure shows a block of mass *M* hanging at rest. The light wire fastened to the wall is horizontal and has a tension of 38 N. The wire fastened to the ceiling is also very light, has a tension of 59 N, and makes an angle ϑ with the ceiling. Find the angle ϑ .



A) 50°

B) 40°

C) 33°

D) 65°

E) 45°

Answer:

41) If a satellite moves with constant speed in a perfectly circular orbit around the earth, what is

the direction of the acceleration of the satellite?

A) in the forward direction

B) in the backward direction

C) outward away from the earth

D) inward toward the earth

E) The acceleration is zero because the speed is constant.

Answer:

42) An object moves in a circular path at a constant speed. Compare the direction of the object's

velocity and acceleration vectors.

A) Both vectors point in the same direction.

B) The vectors point in opposite directions.

C) The vectors are perpendicular to each other.

D) The acceleration is zero but the velocity is constant.

Answer:

43) When a car goes around a circular curve on a horizontal road at constant speed, what force causes it to follow the circular path?

A) the normal force from the road

B) the friction force from the road

C) gravity

D) No force causes the car to do this because the car is traveling at constant speed and therefore has no acceleration. Answer:

44) If you swing a bucket of water fast enough in a vertical circle, at the highest point the water does not spill out. This happens because an outward force balances the pull of gravity on the water.

A) True B) False Answer:

45) What is the gravitational force acting on a 59-kg person due to another 59-kg person standing 2.0 m away? We can model each person as a small sphere. ($G = 6.67 \times 10-11 \text{ N} \cdot \text{m2/kg2}$) A) $5.8 \times 10-8 \text{ N}$ B) $8.5 \times 103 \text{ N}$ C) $1.2 \times 10-7 \text{ N}$ D) $9.8 \times 10-10 \text{ N}$ E) $2.0 \times 10-9 \text{ N}$ Answer: