 Ex I F04

MULTIPLE CHOICE: Choose the one most nearly correct answer and insert its letter into your answer sheet.

1. The instantaneous speed of an object at the midpoint of a trip is defined to be the

a. distance it travels divided by the time the trip takes.
b. distance it travels multiplied by the time the trip takes.
c. the speed precisely at the midpoint of the trip.
d. the distance traveled during a very small time interval near the mid point of the trip divided by the size of the small time interval
e. the initial speed plus the acceleration times half the time of the trip.

2. A bicyclist covers 60 miles between 2 pm and 6 pm. What was his average speed?

a. 15 mph
b. 30 mph
c. 45 mph
d. 60 mph
e. Not enough information is given to be able to say.

3. A Honda takes ten minutes to go from milepost 71 to milepost 81. A Toyota takes fifteen minutes to go from milepost 65 to milepost 80. Which car has the higher average speed?

a. the Honda.
b. the Toyota.
c. The average speeds are the same.
d. We need to know the accelerations to answer the question.
e. Not enough information is given to be able to say.

4. What average speed, most nearly, is required to run a mile (1.6 km), in 4 minutes?

a. 4.0 m/s
b. 7.0 m/s
c. 40.0 m/sec
d. 70 m/s
e. 400m/s

5. The average speed of an object is defined to be

a. one half of the sum of the maximum and the minimum speeds.
b. distance it travels multiplied by the time it takes.
c. the distance it travels divided by the time it takes.
d. the speed determined over an infinitesimally small time interval.
e. the value of the speed at the midpoint of the time interval.

6. Dimensionally, which of the following could be a velocity?

a. 5 meters
b. 5 meters west
c. 5 meters per second
d. 5 meters per second west
e. 5 meters per second per second

7. Which of the following should be considered to be an "accelerator" in an automobile?

a. gas pedal
b. brake pedal
c. steering wheel
d. None of these is an accelerator properly so called
e. All of theses are accelerators properly so called.

8. If a car requires 30 seconds to accelerate from zero to 90 km per hour, its average acceleration is, most nearly,

a. 800 m/ sec^2
b. 80 m/ sec^2
c. 8 m/sec^2
d. 0.8 m/sec^2
e. 0.08 m/sec^2

9. In the strobe diagram below the ball is moving from left to right. Which statement best describes the motion? The ball is

o o o o o oo

a. not accelerating.
b. speeding up.
c. slowing down.
d. moving with a constant speed.
e. none of the above.

10. Which of the following strobe diagrams corresponds to a situation where the ball has zero acceleration?

a. o o o o o o o
b. o o o o o
c. o o o o o o o o o
d. o o o o o o o o
e. none of the above

11. A sheet of paper and a book fell at different rates in the classroom until the paper was wadded up into a ball. We then claimed that if the air resistance could be neglected, all objects would fall at

a. the same constant speed regardless of the type of material.
b. the same constant speed regardless of how much they weigh.
c. different constant speeds depending on the type of material.
d. the same constant acceleration.
e. different accelerations proportional to their masses.

12. The motion of a block sliding down a frictionless ramp can be described as motion with

a. a constant speed, independent of the slope of the ramp.
b. a constant speed that depends on the slope of the ramp.
c. an acceleration which increases as the block slides.
d. a constant acceleration less than 10 m/s/s.
e. a constant acceleration greater than 10 m/s/s.

13. If a ball is dropped from rest, it will fall 20 m during the first two seconds. How far will it fall during the third and fourth seconds?

a. 20 m
b. 30 m
c. 40 m
d. 50 m
e. 60 m

14. A ball with a mass of 0.5 kg is thrown vertically upward with a speed of 15 m/s. What are its speed and direction two seconds later?

a. 10 m/s upward
b. 5 m/s upward
c. zero
d. 5 m/s downward
e. 10 m/s downward

15. If we use plus and minus signs to indicate the directions of velocity and acceleration in one dimension, in which of the following situations does the object speed up?

a. negative velocity and negative acceleration
b. positive velocity and negative acceleration
c. positive velocity and zero acceleration
d. negative velocity and positive acceleration
e. none of the above.

17. A car initially traveling north at 5 m/s has a constant acceleration of 2 m/s^2 northward. How far does the car travel in the first 10 s?

a. 20 m
b. 50 m
c. 100 m
d. 150 m
e. 250 m

18. You decide to launch a ball vertically so that a friend located 45 m above you can catch it. What is the minimum launch speed you can use?

a. 4.5 m/s
b. 150 m/s
c. 30 m/s
d. 45 m/s
e 90 m/s

19. What is the net force on an 900-kg airplane flying with a constant velocity of 180 km/hour north?

a. zero
b. 180 N
c. 1800 N
d. 9000 N
e. None of the above is within 10% of the correct answer.

20. There are three forces acting on an object: 6 N to the left, 5 N to the right, and 3 N to the left. What is the net force acting on the object?

a. 4 N
b. 4 N left
c. 4 N right
d. 8 N left
e None of the above.

21. If the net force on a hot-air balloon is directed straight upward, which way does the acceleration point?

a. Downward only if the balloon is fallling
b. Upward only if the balloon is rising
c. Upward and in the downwind direction.
d. Upward
e. None of the above: a hot air ballon floats in the atmosphere with zero acceleration.

22. If you push on a railroad boxcar with a force of 300 N and it doesn't move, you can conclude that

a. Newton's second law is not valid.
b. This force is canceled by its third law partner force.
c. The boxcar has too much mass to accelerate.
d. There must surely be a force of 300 N applied in the opposite direction.
e Galileo's Principle of inertia is not relevant.

23. The same net force is applied to object A and object B. The observed accelerations of the two objects are not the same; object A has an acceleration three times that of object B. Which of the following is correct?

a. Object A has three times the mass of object B.
b. Object A has one-third the mass of object B.
c. There may be some other unexpected force accelerating A.
d. There may be some other unexpected force decelerating B.
e. None of the above is consistent with the facts stated.

24. Which of the following is not a vector quantity?

a. force
b. acceleration
c. weight
d. mass
e. All of the above are vector quantities.

25. The strength of gravity on Mars is only 40% of that on earth. If a child has a mass of 60 kg on earth, what would the child's weight be on Mars?
    a. 24 N
    b. 60 N
    c. 240 N
    d. 600 N
    e None of the above is correct within 10%.

26. A ball with a weight of 20 N is thrown vertically upward. What is the acceleration of the ball just as it reaches the top of its path?
    a. zero
    b. 10 m/s^2 downward
    c. 10 m/s^2 upward
    d. 20 m/s^2 downward
    e. 20 m/s^2 upward

27. A parachutist reaches terminal speed when
    a. her weight goes to zero.
    b. the force of air resistance exceeds her weight.
    c. the force of air resistance equals her weight.
    d. the force of air resistance equals her mass.
    e. only when she spreads our her limbs to increase the air resistance.

28. Two steel balls have the same size and shape, but one is hollow. They are dropped in air and their terminal speeds are measured. Which of the following statements is correct?
    a. The hollow ball has a smaller terminal speed because it requires a smaller air resistance to cancel the gravitational force on it.
    b. The hollow ball has a larger terminal speed because it requires a smaller air resistance to cancel the gravitational force on it.
    c. The terminal speeds are the same because the acceleration of gravity doesn't depend on mass.
    d. The terminal speeds are the same and equal to 10 m/s.
    e. None of the above statements is true.

29. A 50-kg crate is being pushed across a horizontal floor by a horizontal force of 575 N. If the coefficient of sliding friction is 0.25, what is the acceleration of the crate?
    a. zero
    b. 1 m/s^2
    c. 3 m/s^2
    d. 6 m/s^2
    e. 9 m/s^2

30. You apply a 75-N force to pull a child's wagon across the floor at a constant speed of 0.5 m/s. If you increase your pull to 90 N, the wagon will
    a. continue to move at 0.5 m/s.
    b. speed up immediately and then move at the faster constant speed of 0.6 m/s.
    c. speed up gradually until it reaches the speed of 0.6 m/s and then move at tthat constant speed.
    d. continue to speed up as long as you keep pulling.
    e do none of the above.

31. If the earth exerts a gravitational force of 20,000 N on a satellite of mass 500 kg moving along a synchronous orbit, what force does the satellite exert on the earth?
    a. zero
    b. a small fraction of 1 N
    c. 5000 N
    d. 20,000 N
    e. None of the above.

32. Which of the following is the third-law force that accompanies the force that an apple exerts on a tree? It is
    a. the force that the earth exerts on the apple.
    b. the force that the apple exerts on the earth.
    c. the force that the tree exerts on the apple.
    d. the force that the air exerts on the apple.
    e None of the above forces.

33. A book sits at rest on a table. Which force does Newton's third law tell us is equal and opposite to the gravitational force acting on the book?
    a. the normal force by the table on the book
    b. the normal force by the book on the table
    c. the gravitational force by the book on the Earth
    d. the net force on the book
    e. None of the above.

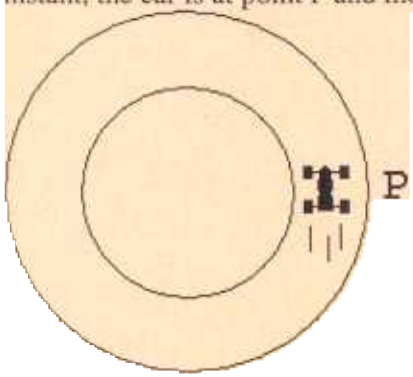
34. You leap from a bridge with a bungee cord tied around your ankles. As you approach the river below, the bungee cord begins to stretch and you begin to slow down. The force of the cord on your ankles which slows you must be _____ your weight?
    a. less than
    b. equal to
    c. greater than
    d. much greater than
    e There is not enough information to be sure of any of the above.

35. Terry and Chris pull hand-over-hand on opposite ends of a rope while standing on a frictionless frozen pond. Terry's mass is 25 kg and Chris's mass is 75 kg. If Terry's acceleration is 12 m/s^2, what is Chris's acceleration?
    a. 36 m/s^2
    b. 12 m/s^2
    c. 6 m/s^2
    d. 4 m/s^2
    e. None of the above is within 10% of the correct answer.

36. A child stands on a bathroom scale while riding in an elevator. The child's weight when the elevator is not moving is 100 lbs. What does the scale read when the elevator accelerates upward while traveling downward?
    a. greater than 100 lbs
    b. less than 100 lbs
    c. exactly 100 lbs
    d. The same as it reads when accelerating downward while trvelling upward, by symmetry.
    e. None of the above.

37. If a race car is traveling around a circular track at a constant speed of 100 mph, we know that the car experiences
    a. no net force.
    b. a centripetal force.
    c. a centrifugal force.
    d. a net force in the forward direction.
    e. all of the above.

Figure 38
A racecar is moving counterclockwise on a circular path as shown in the diagram above. Imagine that at this instant, the car is at point P and moving at a speed of 100 mph, upward on the page.



38. Refer to **Figure 38** In what direction does the net force point?
    a. ↑
    b. ↓
    c. →
    d. ←
    e.

39. Refer to **Figure 38** In what direction does the acceleration point?
    a. ↑
    b. ↓
    c. →
    d. ←
    e.

40. Refer to **Figure 38** Imagine that the car hits a large oil slick that reduces the force of friction to zero. In what direction will the car slide?
    a. ↑
    b. ↓
    c. →
    d. ←
    e.

41. In straight line motion the
    a. acceleration is parallel (or antiparallel) to the velocity.
    b. acceleration is perpendicular to the velocity.
    c. acceleration is vertical, while the velocity can be in any direction.
    d. acceleration is vertical and the velocity is horizontal.
    e. none of the above statements is true.

42. In uniform circular motion the
    a. acceleration is parallel (or antiparallel) to the velocity.
    b. acceleration is perpendicular to the velocity.
    c. acceleration is vertical, while the velocity can be in any direction.
    d. acceleration is vertical and the velocity is horizontal.
    e. none of the above statements is true.

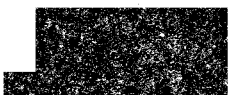
43. A migrating bird is initially flying south at 6 m/s. To avoid hitting a high-rise building, the bird veers and changes its velocity to 8 m/s east over a period of 2 s. What is the magnitude of the bird's average acceleration during this 2-s interval?
    a. 1 m/s^2
    b. 3 m/s^2
    c. 4 m/s^2
    d. 5 m/s^2
    e. None of the above is within 10% of the correct answer.

44. What centripetal acceleration is required to follow a circular path with a radius of 50 m at a speed of 20 m/s?
    a. 2 m/s/s
    b. 4 m/s/s
    c. 6 m/s/s
    d. 8 m/s/s
    e. None of the above is within 10% of the correct answer.

45. A 60-kg person on a merry-go-round is traveling in a circle with a radius of 3 m at a speed of 6 m/s. What is the magnitude of the net force experienced by this person?
    a. zero
    b. 60 N
    c. 180 N
    d. 600 N
    e. 720 N

46. A cyclist turns a corner with a radius of 50 m at a speed of 20 m/s. What is the magnitude of the cyclist's acceleration?
    a. 0.4 m/s^2
    b. 2.5 m/s^2
    c. 400 m/s^2
    d. 1000 m/s^2
    e. None of the above is within 10% of the correct answer.

47. A red ball is thrown straight down from the edge of a tall cliff with a speed of 30 m/s. At the same time a green ball is thrown straight up with the same speed. If the green ball travels up, stops, and then drops to the bottom of the cliff, how many seconds later than the red ball will it land?
    a. 3 s
    b. 2.45 s
    c. 4.9 s
    d. 6 s
    e. None of the above is within 10% of the correct answer.



48. A red ball is thrown straight down from the edge of a tall cliff with a speed of 30 m/s. At the same time a green ball is thrown straight up with the same speed. If the green ball travels up, stops, and then drops to the bottom of the cliff, which ball (if either) will be traveling fastest when it reaches the ground below? (Neglect air resistance.)
    a. The red ball
    b. The green ball
    c. Both balls will be traveling at the same speed.
    d. Without air resistance there is not enough information to say.
    e. None of the above.

Scenario 49
A gun is held horizontally and fired. At the same time the bullet leaves the gun's barrel an identical bullet is dropped from the same height. Neglect air resistance.

49. Refer to **Scenario 49**. Which bullet will hit the ground with the greatest velocity?
    a. The bullet that was fired, because it feels the force of gravity over a longer distance.
    b. The bullet that was dropped, because it falls for a longer time
    c. It will be a tie, because the acceleration of gravity is the same for both.
    d. The bullet that was fired.
    e. The bullet that was dropped.

50. Which of the following statements about projectile motion is true (neglecting air resistance)?
    a. The horizontal and vertical motions are independent.
    b. The force on the projectile is constant throughout the flight.
    c. The acceleration of the projectile is constant throughout the flight.
    d. The force on the projectile is always vertically downward
    e. All of the above statements are true.

51. In projectile motion the
    a. acceleration is parallel (or antiparallel) to the velocity.
    b. acceleration is perpendicular to the velocity.
    c. acceleration is vertical, while the velocity can be in any direction.
    d. acceleration is vertical and the velocity is horizontal.
    e. acceleration varies as the projectile rises towards it maximum height..

52. A physics student reports that upon arrival on planet X, he promptly sets up the "monkey-shoot" demonstration. If the gravity on planet X is twice what it is on earth, he should obtain a
    a. miss since the monkey's weight is twice as big now.
    b. hit only if the ball's horizontal velocity is increased.
    c. miss since the monkey's mass is unchanged.
    d. hit since the ball and the monkey fall vertically at the same rate.
    e. None of the above.

53. Just after being hit, a baseball has a horizontal speed of 20 m/s and a vertical speed of 25 m/s upward. Ignoring air resistance what are these speeds two seconds later?
    a. 20 m/s horizontal and 5 m/s downward
    b. 20 m/s horizontal and 15 m/s upward
    c. 10 m/s horizontal and 5 m/s upward
    d. 20 m/s horizontal and 45 m/s downward
    e. 20 m/s horizontal and 5 m/s upward

54. A tennis ball is hit with a vertical speed of 10 m/s upwards and a horizontal speed of 30 m/s. How far will the ball travel horizontally before landing?
    a. 10 m
    b. 20 m
    c. 40 m
    d. 60 m
    e. 80 m

The remaining problems may require some computation. Choose the single best answer and enter your choice into the NCS-Scantron answer sheet.

55. To determine the height of a steep cliff an experimenter stations his assistant on the top of the cliff and fires a pellet vertically upward with a speed of 80 m/s. His assistant notes that the pellet reaches its maximum height just 3 m above the edge of the cliff. How high is the cliff?

    a). 77 m ; b). 237 m; c). 317 m; d). 637 m; e). 797 m.

56. A dirt bike starts up a steep hill with a speed of 5m/s. Since it is underpowered it slows down at the rate of $0.2m/s^2$ as it climbs the hill. It clears the crest of the hill after 15 seconds. How far did the dirt bike travel up the hill?

a). 97.5 m; b). 75 m; c). 52.5 m; d) 15 m; e) none of these is correct within 10%.

57. A rope is used to drag a box across a rough warehouse floor. Its angle is 30 degrees above the horizontal, and the its tension is T. If the box has a mass of 15 kg, feels a frictional drag force of 75 N, and is accelerating horizontally at 0.5 m/s^2, what is the value of T?

a). 7.5N; b). 37.5 N; c) 75 N; d) 82.5 N; e) 95.3 N.

58. Just after it is launched a 600 kg rocket feels a gravitational attraction by the earth of about 6000 N. Compute the acceleration of the earth due to the force which Newton's third law guarantees that the satellite exerts on the earth. (Use $M_E = 6 \text{ X } 10^{24}$ kg). The acceleration is most nearly

a) 10^{22} m/s^2; b) 10^{21} m/s^2; c) 10^{-22} m/s^2; d) 10^{-23} m/s^2; e) None of these is within 10%.

Scenario 59. Suppose that the moon travels in a circle about the earth at a distance of $3.84 \text{ X } 10^8$ m once in every 28.3 days, and that has a mass of $7.4 \text{ X}10^{22}$ kg. Then answer the following two questions.

59. The speed of the moon is most nearly:
a) 10 m/s; b) 10^3 m/s; c) 10^5 m/s; d) 10^7 m/s; e)none of these is within 10%.

60. The acceleration of the moon is most nearly:
a) $2.6\text{X}10^3$ m/s^2; b) 26 m/s^2; c) $2.6\text{X}10^{-3}$ m/s^2; d) $2.6\text{X}10^{-5}$ m/s^2;
or e) $2.6\text{X}10^{-7}$ m/s^2.

END of EXAM I

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Physics 117 Exam I, Cover Page

A) GENERAL INSTRUCTIONS

This exam consists of 60 questions worth two points each for a maximum of 120 points.

ALL ANSWERS MUST BE ENTERED INTO THE NCS ANSWER SHEET BY MEANS OF HEAVY BLACK MARKS WITH A NUMBER 2 PENCIL. (Only a pencil mark will work; the optical scanner cannot read inked answers no matter what color or how dark.)

The questions are numbered from 1 to 60: make sure you enter your single letter answer into the answer line with the same number as the question you are answering.

Only the computer readable NCS answer sheet will be handed in. Keep this exam for you future use.

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B) PREPARE YOUR ANSWER SHEET IN ADVANCE:

1) SIGN YOUR PERSONAL SIGNATURE INTO THE TOP MARGIN ABOVE THE NAME BOX.
2) PRINT YOUR NAME, **FAMILY NAME FIRST**, INTO THE BOXES PROVIDED AND DARKEN THE CIRCLE FOR THE CORRESPONDING LETTER BELOW EACH BOX
3) INSERT YOUR STUDENT ID NUMBER UNDER "IDENTIFICATION NUMBER" AND DARKEN THE CORRESPONDING CIRCLES BELOW EACH NUMBER.
4) MAKE NO STRAY MARKS ON THE ANSWER SHEET AND ERASE CLEANLY IF NECESSARY.

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C) GENERAL ADVICE

Many students will not have time to finish this exam if they proceed at a leisurely pace. Therefore it is probably advantageous to earmark time-consuming items for later attention and skip forward to questions that can be answered more easily. No subtractions will be made for wrong answers, so that last minute best guessing is probably an advantageous strategy.

IF YOU NEED HELP, ASK!.....AND ASK EARLY RATHER THAN LATE.

ALSO FOR FAIRNESS' SAKE, PLEASE STOP WRITING WHEN THE EXAM ENDS. A PENALTY OF 8% OF THE RAW SCORE MAY BE IMPOSED UPON STUDENTS WHO TRY TO TAKE UNFAIR ADVANTAGE OF THE COLLECTION PROCESS BY CONTINUING TO WRITE AFTER THE END HAS BEEN ANNOUNCED.