

**DO NOT OPEN THE EXAMINATION PAPER UNTIL
YOU ARE TOLD BY THE SUPERVISOR TO BEGIN**

**PHYSICS 2204
MIDTERM EXAMINATION
2008/2009**

Value: 100 marks

Time: 3 hours

GENERAL INSTRUCTIONS

1. This is a two-part test. All parts are contained in this booklet. The examination consists of items arranged as follows:
SECTION I – 50 selected response items – Do ALL items – 50%
SECTION II – constructed response items – Do ALL items – 50%
2. **Section I** may be answered using the answer sheet provided. Instructions for completing this answer sheet are given on the sheet itself. Please complete it according to those instructions and any other given by the supervisor.
3. **Section II** – is to be answered in the spaces provided in this test booklet. Please pass in the entire test to the supervisor when you have finished the examination.
4. Rough work may be done in any blank spaces in this test booklet.

REGULATIONS FOR CANDIDATES

Candidates are expected to be thoroughly familiar with all regulations pertaining to their conduct during the examinations. These were explained by the chief supervisor prior to the first session, and have been posted for further reference near the entrance to the examination room. Candidates should ensure that they understand and comply with all requirements governing the following matters:

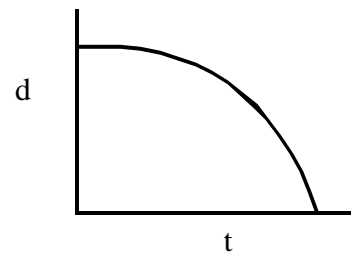
- Materials required
- Materials not permitted
- Models of calculators permitted
- Use of pen or pencil
- Communication and movement during the examination
- Use of unauthorized means, and penalties
- Punctuality
- Leaving the room
- Use of answer booklets
- Completion of required information

PART I
Total Value: 50%

Instructions: Shade the letter of the correct answer on the computer scorable answer sheet provided.

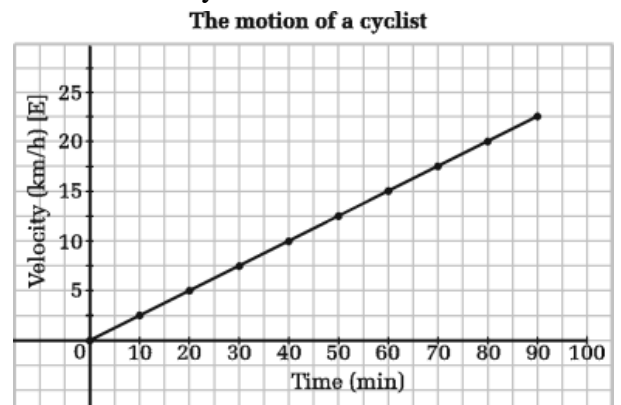
1. How many significant digits are there in 0.000304060?
(A) 3
(B) 6
(C) 8
(D) 9
2. What is 4.7×10^2 nm expressed in m?
(A) 4.7×10^{-7}
(B) 4.7×10^{-4}
(C) 4.7×10^8
(D) 4.7×10^9
3. Which of the following contains vector quantities only?
(A) acceleration, speed
(B) acceleration, distance
(C) displacement, force
(D) force, speed
4. Which of the following is the best example of uniform motion?
(A) A bowling ball rolls along a school corridor.
(B) A car travels along a circular track with the cruise control set to 100 km/h.
(C) A cart is moved along a level, smooth surface by a net force of 50 N.
(D) A rock falls from a cliff on a calm day.
5. What is 90.0 km/h in m/s?
(A) 25.0 m/s
(B) 32.4 m/s
(C) 250 m/s
(D) 324 m/s
6. A car travels 23.0 km in 15 min. What is its speed?
(A) 0.65 km/h
(B) 1.5 km/h
(C) 5.8 km/h
(D) 92 km/h

7. Which choice best describes the motion depicted in the graph?
(A) moving to the left and slowing down
(B) moving to the left and speeding up
(C) moving to the right and slowing down
(D) moving to the right and speeding up

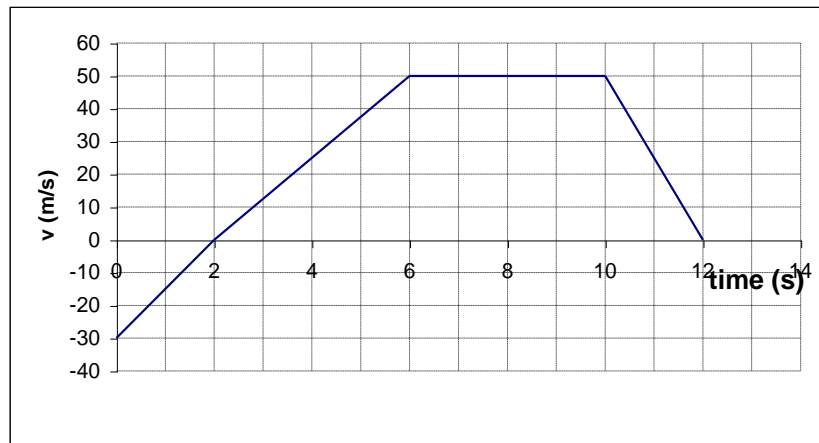


8. The following graph shows the motion of a cyclist. What is the cyclist's total displacement?

- (A) 4.0 km [E]
- (B) 17 km [E]
- (C) 34 km [E]
- (D) 1.0×10^3 km [E]

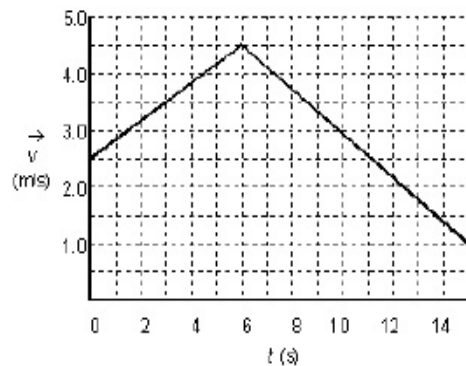


9. If we assume that motion to the right is positive, then which of the following statements describes the motion of the object depicted in the graph from $t = 10$ s to $t = 12$ s?



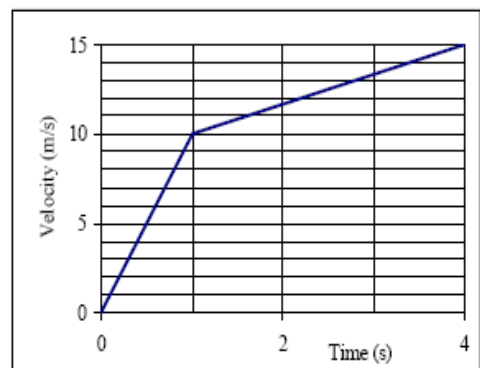
- (A) moving to the left and slowing down
 (B) moving to the left and speeding up
 (C) moving to the right and slowing down
 (D) moving to the right and speeding up
10. Examine the $\vec{v}-t$ graph shown at the right. What is the acceleration at $t = 10$ s?

- (A) -0.3 m/s^2
 (B) -0.39 m/s^2
 (C) -0.50 m/s^2
 (D) $+0.3 \text{ m/s}^2$



11. On a velocity vs. time graph, what does a sloping straight line represent?
 (A) constant displacement
 (B) constant speed
 (C) constant velocity
 (D) uniform acceleration
12. The velocity-time graph shows the motion of an object during a 4.0 s time interval. What was the net displacement from $t = 1$ s to $t = 4$ s?

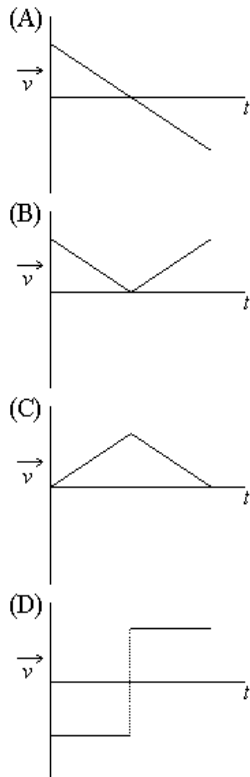
- (A) 3.25 m
 (B) 7.5 m
 (C) 15 m
 (D) 37.5 m



13. An object's velocity vector is directed to the right and its acceleration vector is directed to the right. What is true about the motion of the object?
 (A) It is moving to the left and increasing speed.
 (B) It is moving to the left and slowing down.
 (C) It is moving to the right and increasing speed.
 (D) It is moving to the right and slowing down.

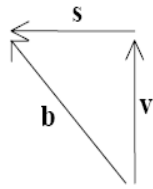
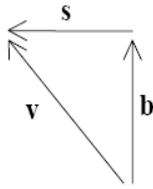
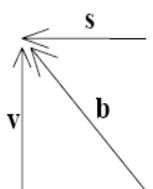
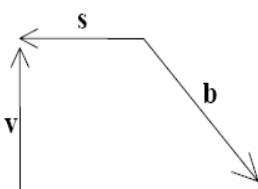
14. What is the average velocity of an object that travels 6.00 m north at 2.00 m/s and then travels south at 3.00 m/s for 1.00 second?
- (A) 0.750 m/s [N]
 (B) 2.25 m/s [N]
 (C) 2.50 m/s [N]
 (D) 3.75 m/s [N]

15. A ball is initially rolling up a ramp at 5 m/s. It slows down, stops momentarily and then rolls back down the ramp. Which graph most accurately depicts the motion?



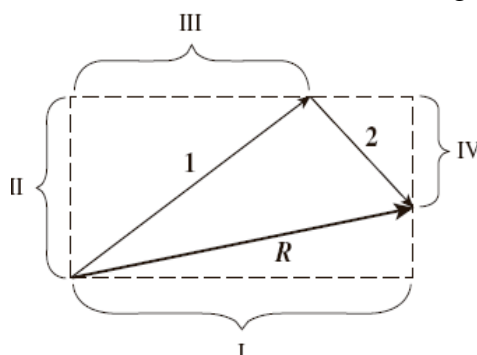
16. A person travels 100 km by car in a time of 2 h and then 400 km/h by plane for 3 h. What is the average speed?
- (A) 100 km/h
 (B) 225 km/h
 (C) 250 km/h
 (D) 260 km/h
17. A rolling cart, initially traveling at 6.2 m/s [E], undergoes a uniform acceleration for 3.6 s. What would be its acceleration after this time if it traveled at 4.9 m/s [W]?
- (A) 0.36 m/s^2 [W]
 (B) 3.1 m/s^2 [W]
 (C) 3.1 m/s^2 [E]
 (D) 8.4 m/s^2 [E]
18. A skier accelerates at 5 m/s^2 . What is the increase in speed of the skier between the fourth and fifth seconds?
- (A) 5 m/s
 (B) 15 m/s
 (C) 20 m/s
 (D) 25 m/s
19. A jogger is running at 4.2 m/s when she begins to accelerate uniformly. If she runs a distance of 14 m in the next 3.0 s, what is her new speed?
- (A) 4.9 m/s
 (B) 5.1 m/s
 (C) 7.7 m/s
 (D) 14 m/s

20. A car accelerates from 30 m/s to 50 m/s in 1.4 s. How far does it travel during this time?
- (A) 28 m
 - (B) 42 m
 - (C) 56 m
 - (D) 70 m
21. What is the initial velocity of a rock thrown straight down into water 5.20 m below, if it strikes the water 0.524 s after being thrown?
- (A) - 16.1 m/s
 - (B) - 12.1 m/s
 - (C) -7.36 m/s
 - (D) 7.77 m/s
22. An object is thrown vertically upward at 18 m/s from a window and hits the ground 1.6 s later. What is the height of the window above the ground?
- (A) 16 m
 - (B) 21 m
 - (C) 37 m
 - (D) 41 m
23. A ball is thrown vertically upward at 18 m/s from a height of 45 m above the ground. What is its speed on impact with the ground below?
- (A) 20 m/s
 - (B) 24 m/s
 - (C) 35 m/s
 - (D) 49 m/s
24. How long does it take a car to slow down from a speed of 64 km/h to 42 km/h over a distance of 75 m?
- (A) 1.4 s
 - (B) 2.5 s
 - (C) 2.8 s
 - (D) 5.1 s
25. If a ball is thrown vertically upwards at 8.0 m/s, how much time will elapse until it returns to the same point from which it was thrown?
- (A) 0.82 s
 - (B) 1.2 s
 - (C) 1.6 s
 - (D) 6.5 s
26. A ball is dropped from rest from a tower and strikes the ground 125 m below. Approximately how many seconds does it take for the ball to strike the ground after being dropped? Neglect air resistance.
- (A) 2.50 s
 - (B) 3.50 s
 - (C) 5.05 s
 - (D) 12.5 s
27. A car, initially traveling at 22 m/s [East], is brought to a complete stop over a distance of 80 m. What was the acceleration?
- (A) 3.0 m/s^2 [E]
 - (B) 3.0 m/s^2 [W]
 - (C) 3.6 m/s^2 [E]
 - (D) 12.1 m/s^2 [W]
28. A car, initially moving at 16 m/s to the right is slowed to a speed of 10.0 m/s to the right by a braking acceleration of 2.0 m/s^2 . How far does the car go while slowing down?
- (A) 3 m
 - (B) 9 m
 - (C) 39 m
 - (D) 78 m

29. If a ball is thrown vertically upwards at 38 m/s from a height of 12 m. When the ball reaches its maximum height, how high is it above the ground?
- (A) 74 m
 (B) 86 m
 (C) 147 m
 (D) 159 m
30. Car A is traveling at 110 km/h [W] on a highway when it overtakes car B which is traveling at 75 km/h [W] on the same highway. What is the velocity of car B relative to car A?
- (A) 35 km/h [E]
 (B) 35 km/h [W]
 (B) 185 km/h [E]
 (D) 185 km/h [W]
31. Truck X is traveling North at 45 km/h while directly behind it truck Y is travelling South at 65 km/h. What is the velocity of X relative to Y?
- (A) 20 km/h [N]
 (B) 20 km/h [S]
 (C) 110 km/h [N]
 (D) 110 km/h [S]
32. The stream in a river flows to the West with a velocity \mathbf{s} . You point your boat toward the North and row with a velocity \mathbf{b} . The boat moves with a velocity \mathbf{v} relative to the Earth. Which vector diagram correctly shows the information?
- (A) 
- (B) 
- (C) 
- (D) 
33. What is the minimum possible resultant when a pair of forces of magnitude 5 N and 4 N are added together in a variety of ways?
- (A) 0 N
 (B) 1 N
 (C) 5 N
 (D) 9 N
34. Three identical boats set out to cross a river that has a current. Boat A points directly across the river, boat B points 20° downstream from a point straight across the river, and boat C points 20° upstream from a point straight across the river. Which boat will arrive on the opposite shore first?
- (A) all three boats will arrive at the same time
 (B) boat A
 (C) boat B
 (D) boat C
35. What is the magnitude of the horizontal component of a 2.0 N force applied at an angle of 25° to the horizontal?
- (A) 0.85 N
 (B) 0.93 N
 (C) 1.8 N
 (D) 2.0 N

36. A hiker walks 3.0 m east and then 4.0 m south. What is the displacement of the hiker?
- (A) 5.0 m [36.9° South of East]
 (B) 5.0 m [53.1° South of East]
 (C) 7.0 m [36.9° South of East]
 (D) 7.0 m [53.1° South of East]

37. The diagram below shows the resultant vector R of adding vector 1 and vector 2 .



Which of the following represents the magnitude of the vertical component of vector 1 ?

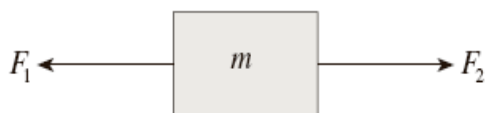
- (A) I
 (B) II
 (C) III
 (D) IV
38. A pilot wishes to travel north in an airplane that can travel at a speed of 3.00×10^2 km/h relative to the air. If the wind is blowing at 80.0 km/h [W], what is the heading the plane should fly?
- (A) [N 14.9° E]
 (B) [N 14.9° W]
 (C) [N 15.5° E]
 (D) [N 15.5° W]

39. What is the opposite of the following vector: 20 km [N 30° E]?
- (A) 20 km [E 30° N]
 (B) 20 km [E 60° N]
 (C) 20 km [S 30° W]
 (D) 20 km [S 60° W]

40. Which branch of physics studies how objects move?
- (A) dynamics
 (B) equilibrium
 (C) kinematics
 (D) statics

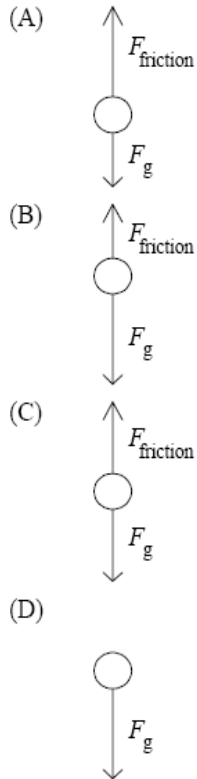
41. Most common everyday mechanical forces, such as pushing a car and stretching a rubber band, are examples of what type of force?
- (A) electric
 (B) gravitational
 (C) strong nuclear
 (D) weak nuclear

42. If the only forces acting on the object shown below are equal in magnitude, which of the following is **not possible**?



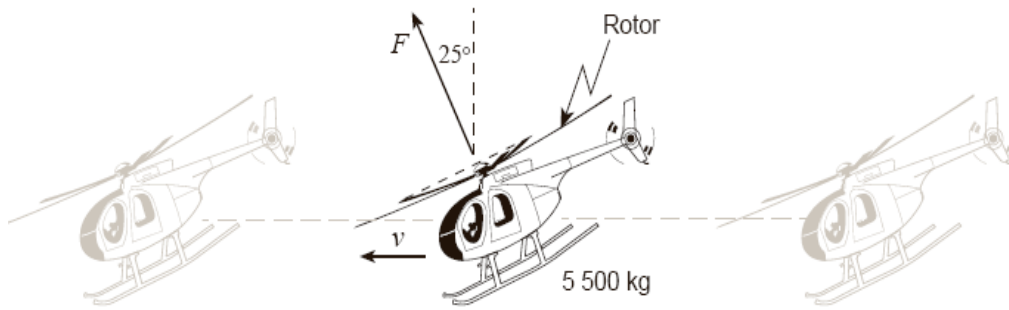
- (A) The object is at rest.
 (B) The object is accelerating to the left.
 (C) The object is moving with constant velocity to the right.
 (D) The object is moving with constant velocity towards the top of the page.

43. A Styrofoam ball is falling through the air at terminal velocity. Which free body diagram is the best representation of the event?



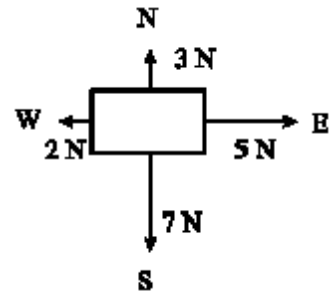
44. Which of the following is a list of nature's basic forces, in order from weakest to strongest?
- (A) electromagnetic, gravity, weak nuclear, strong nuclear
(B) gravity, electromagnetic, strong nuclear, weak nuclear
(C) gravity, electromagnetic, weak nuclear, strong nuclear
(D) gravity, weak nuclear, electromagnetic, strong nuclear
45. Suppose that you were transported to a place where $g = 20 \text{ N/kg}$. Which statement would be correct?
- (A) You would have the same mass but would weigh more.
(B) You would have the same mass but would weigh less.
(C) You would have the same mass and weight.
(D) You would have less mass but would weigh more.
46. Which of the following is another expression for gravitational field strength?
- (A) acceleration due to gravity
(B) centripetal acceleration
(C) force of gravity
(D) normal force
47. Which is a characteristic of the mass of an object?
- (A) dependent on its location
(B) measured by a spring balance
(C) measure of its ability to resist changes in its motion
(D) numerically equal to its weight.
48. Which of the following would be a **non-inertial** frame of reference if you were at that location?
- (A) In a balloon ascending at a constant velocity
(B) In an elevator undergoing free-fall
(C) In a stationary elevator
(D) On a train traveling North at 30 m/s

49. A 5 500 kg helicopter is traveling at constant speed in level flight.



What is the force F provided by the rotor?

- (A) $4.9 \times 10^4 \text{ N}$
 (B) $5.4 \times 10^4 \text{ N}$
 (C) $5.9 \times 10^4 \text{ N}$
 (D) $1.2 \times 10^5 \text{ N}$
50. What is the equilibrant force on the object in the diagram to the right?
- (A) 5 N [E 53°S]
 (B) 5 N [W 53°N]
 (C) 25 N [E 37°S]
 (D) 25 N [W 37°N]



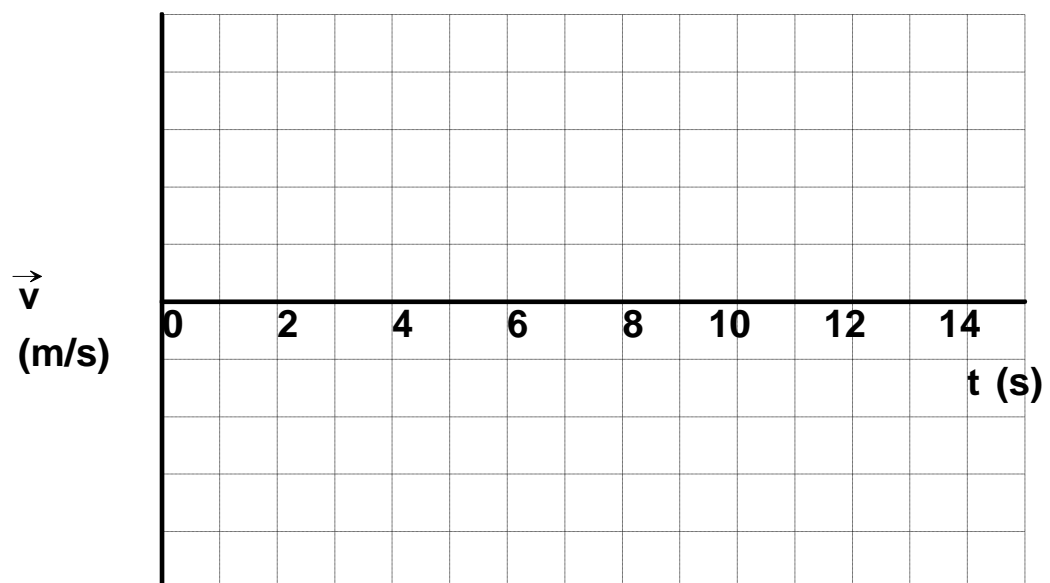
PART II

Total Value: 50%

Instructions: Complete all items in this section. Your responses should be clearly presented in a well organized manner with proper use of units, formulae and significant figures where appropriate.

Value

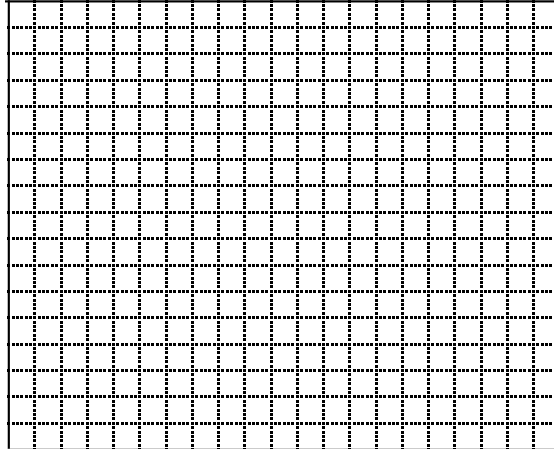
- 4% 51. (A) Sketch a velocity vs. time graph for a car that travels to the right at 6 m/s^2 for 4 seconds, then accelerates to the left at 4.5 m/s^2 for 8 seconds and then continues moving at whatever speed it has attained for another three seconds.



- (B) A car travelling at 10.0 m/s passes a stopped truck. **Four seconds** after the car passes, the truck accelerates from rest at 2.50 m/s^2 until it reaches 15m/s. Then the truck continues at a speed of 15 m/s.

4%

- (i) Plot a velocity - time graph for the car and the truck on the grid.



4%

- (ii) When did truck catch the car?

52. (A) An arrow is shot vertically into the air with an initial velocity of 60.0 m/s.

2%

- (i) How long does it take the arrow to reach its maximum height?

2%

- (ii) What is the displacement of the arrow at 7.0 s?

4%

- (B) You are driving with a constant velocity of 25.0 m/s when a child suddenly steps into the path of your vehicle 55 m away. When you fully apply your brakes, your car slows down at a constant rate of 8.0 m/s^2 . What is the **minimum reaction time** that is required so that the child will not be hit?

- 4% (C) You are standing below a cliff and toss a softball up to your friend who is standing on the edge of the cliff, 8.0 m above you. The ball goes up, up past your friend, who then catches it on the way **DOWN**. The initial speed of the ball is 30.0 m/s. At what time will your friend catch the ball on the way down?
- 5% (D) A car is stopped at an intersection. When the traffic light turns green, the car starts to accelerate at 1.5 m/s^2 . A truck continues through the intersection, at a constant speed of 12 m/s, and passes the car at the same time that it starts to accelerate. How long does the car take to catch up with the truck?
- 5% 53. (A) Jason walks 195 m [W], 168 m [N 62° E] and then 186 m [E 42° S]. What is Jason's total displacement?

(B) Brad attempts to row his canoe North across a river. He paddles at a rate of 5.80 m/s across the river but the current pushes him East at a rate of 1.45 m/s.

4%

(i) What is the velocity of the canoeist relative to the bank of the river?

4%

(ii) If the river is 4.0×10^2 m wide, how far downstream is Brad when he reaches the opposite bank?

54 A pilot in a solar powered airplane has an air speed of 128 km/h. The pilot wants to fly directly North from Corner Brook to St. Anthony, a distance of 425 km. When she takes off, the wind is blowing from the West with a speed of 55.0 km/h.

3%

(A) In what direction should the pilot fly in order to seek her destination?

2%

(B) What is her velocity with respect to the ground?

3%

55. A 35 kg traffic light is suspended by two wires as shown. What is the tension in the left-hand wire?

