

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

PHYSICS 2204
MIDTERM EXAMINATION
2010/2011

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 on the loose leaf provided. 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

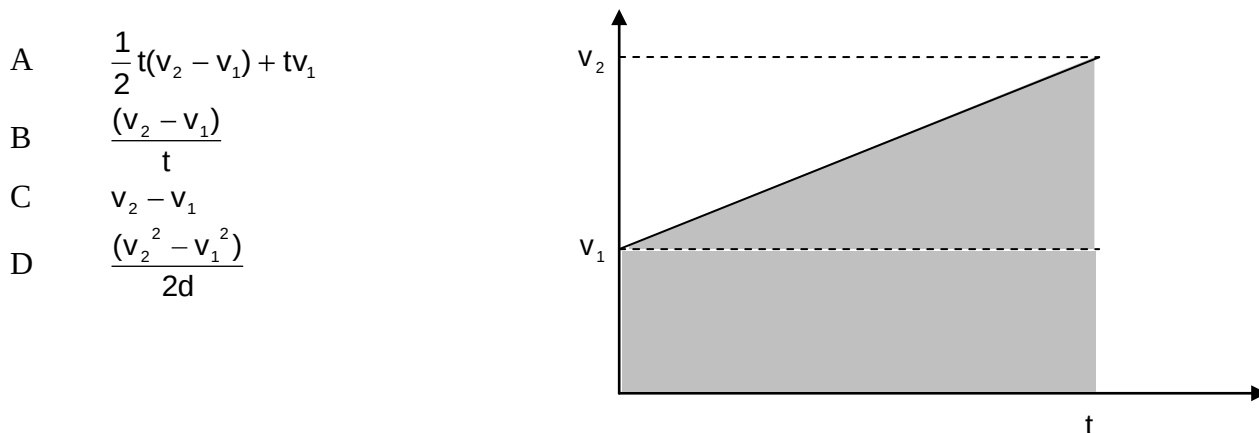
Candidates are expected to be thoroughly familiar with all regulations pertaining to their conduct during the examinations. These were explained by the chief supervisor prior to the first session, and have been posted for further reference near the entrance to the examination room. Candidates should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

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

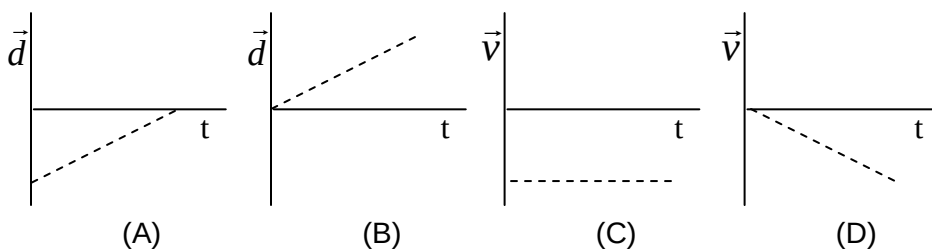
PART I
Total Value: 50%

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

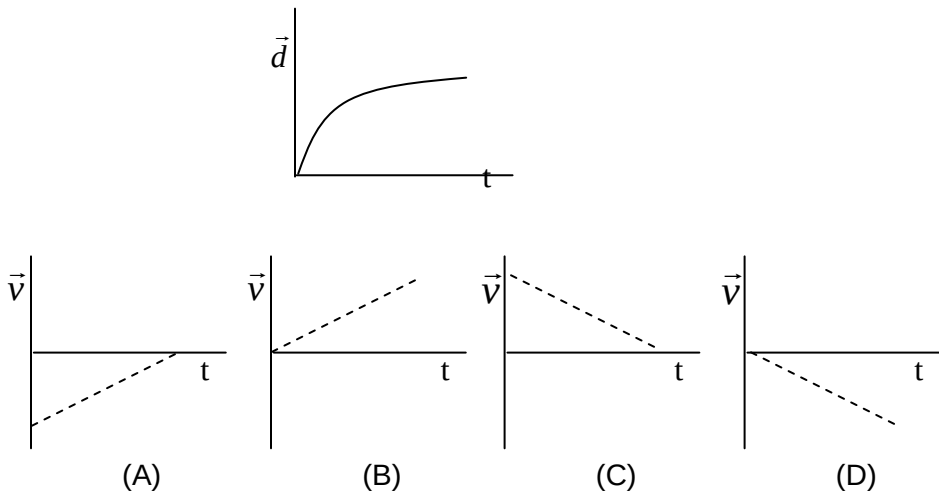
- 1 What is 90.0 km/h in m/s?
 A 25.0 m/s
 B 32.4 m/s
 C 250 m/s
 D 324 m/s
- 2 Which of the following contains scalar quantities only?
 A Speed, distance
 B Speed, force
 C Velocity, acceleration
 D Velocity, displacement
- 3 Which of the following is the best example of uniform motion?
 A A child is on a merry-go-round rotating at a constant speed.
 B A rock falls from a cliff on a calm day.
 C A satellite is in orbit about the Earth.
 D A train is travelling west at a constant speed.
- 4 Craig rolls a marble 5 times in a circle in 4.30 s. If the circumference of the circle is 34.1 cm, the average velocity of the marble is:
 A 0.00 m/s
 B 0.0793 m/s
 C 0.397 m/s
 D 7.93 m/s
- 5 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
- 6 The following graph can be used to derive an equation for the acceleration of an object. Which equation below represents the acceleration of an object based on this graph?



- 7 Which graph represents an object moving to the left with uniform velocity?

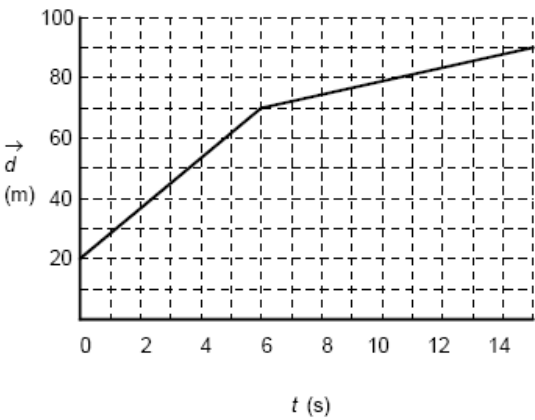


8 Which v-t graph matches the d-t graph shown?

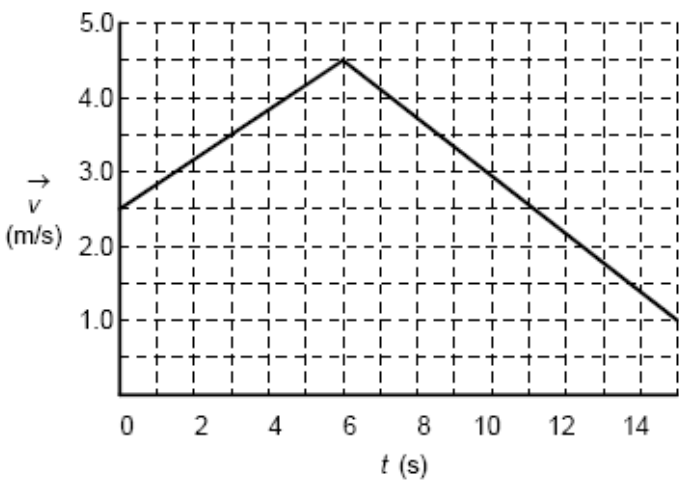


9 Given the position-time graph to the right, calculate the velocity of the object for the first 6.0 seconds.

A 3.3 m/s
 B 8.3 m/s
 C 12 m/s
 D 70 m/s



The next two questions are based on the velocity-time graph below.



10 What is the acceleration of the object at time 4.0 s?

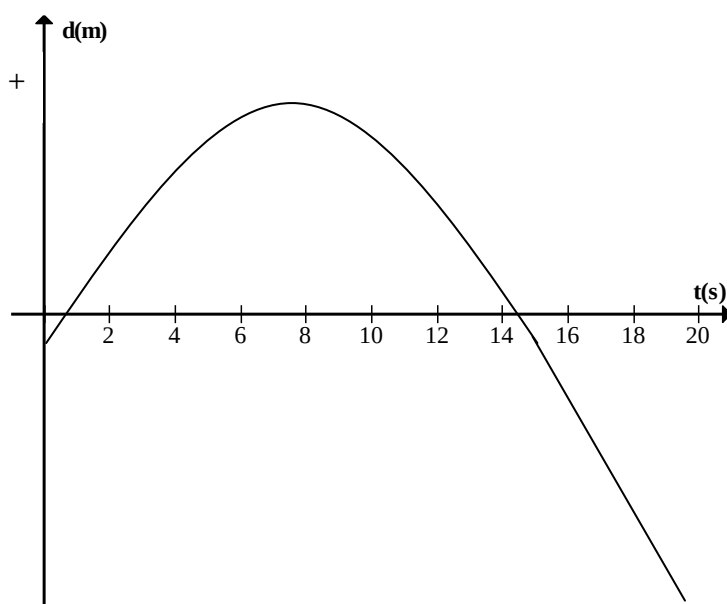
A 0.33 m/s²
 B 0.95 m/s²
 C 1.2 m/s²
 D 4.8 m/s²

11 What is the displacement of the object from time 6.0 s to time 15.0 s?

A -25 m
 B 9.0 m
 C 16 m
 D 25 m

- 12 An object's velocity vector is directed to the left 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.

- 13 Which best describes the graph below?



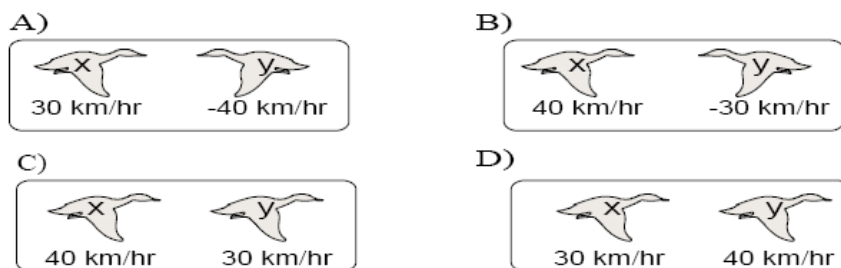
- A object slows down to the right, stops, and speeds up to the left
 - B object slows down to the right, stops, speeds up to the left, stops, and slows down to the left
 - C object speeds up to the right, stops, and speeds up to the right
 - D object speeds up to the right, stops, slows down to the right, stops, and speeds up to the left
- 14 If a runner travels 15.0 km in 2.50 h and then travels at 6.00 km/h for another two hours, find the runner's average speed.
- A 4.67 km/h
 - B 6.00 km/h
 - C 8.40 km/h
 - D 10.8 km/h
- 15 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]
- 16 Two objects, one having three times the mass of the other, are dropped from the same height in a vacuum. At the end of the fall, both will have reached the same velocity. Why?
- A All objects reach the same terminal velocity when dropped from great heights.
 - B The acceleration due to gravity for both objects is the same.
 - C The acceleration due to gravity for the larger object is three times the acceleration due to gravity of the smaller object.
 - D The velocity of anything falling in a vacuum is a constant.
- 17 The picture shows the path of a ball that was thrown vertically into the air from ground level with an initial velocity of +42 m/s. At the position shown, just above ground and coming down, what is the velocity of the ball?
- A - 44 m/s
 - B - 40 m/s
 - C + 40 m/s

D + 44 m/s

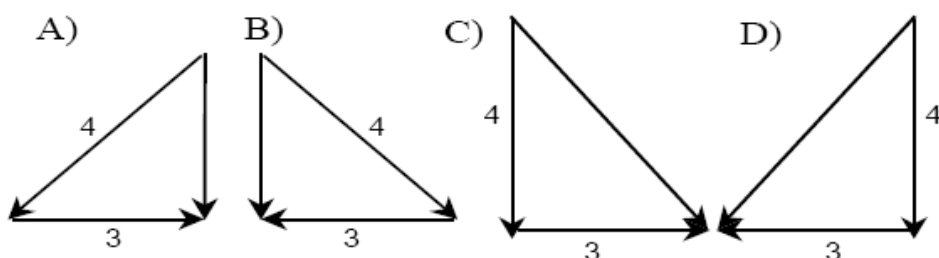
- 18 An object moving at 6.5 m/s [right] comes to a complete stop in 3.2 s. What is the acceleration?
- A 0.49 m/s [left]
B 0.49 m/s [right]
C 2.0 m/s [left]
D 2.0 m/s [right]
- 19 A race car accelerates from 125 km/hr to 230 km/hr at a rate of 5.4 m/s^2 . How far does it travel while accelerating?
- A 9.7 m
B 270 m
C 450 m
D 3500 m
- 20 A balloon 15 m above the ground is moving upwards when a rock is dropped. If the rock takes 2.0 s to reach the ground, what was the initial velocity of the balloon?
- A 2.3 m/s
B 4.6 m/s
C 12.4 m/s
D 17.3 m/s
- 21 A toy car travels 86.0 cm in 2.90 s and reaches 0.380 m/s. Find its initial velocity.
- A 0.213 m/s
B 0.593 m/s
C 0.687 m/s
D 0.973 m/s
- 22 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
- 23 What is the magnitude of the acceleration of an object that changes its velocity from 2.8 m/s to 6.4 m/s over a distance of 15 m?
- A 0.12 m/s^2
B 0.24 m/s^2
C 1.1 m/s^2
D 2.2 m/s^2
- 24 A rock is thrown upwards from the second story window of an apartment building with an initial velocity of 6.80 m/s. What is the speed of the rock as it falls past the first story window located 3.25 m directly below the starting position?
- A 4.18 m/s
B 7.98 m/s
C 8.40 m/s
D 10.5 m/s
- 25 The driver of a car travelling at 25 m/s sees a moose ahead. He applies the brakes and the car slows down at a rate of 8.3 m/s^2 . If the driver's reaction time is 0.60 s, what is the total distance travelled from the time the driver sees the moose until the car stops?
- A 14 m
B 15 m
C 38 m
D 53 m
- 26 An object accelerates at 2.2 m/s^2 for 3.0 s. If the final velocity of the object is 15 m/s, what was the initial velocity?
- A 2.3 m/s

- B 8.4 m/s
- C 16 m/s
- D 22 m/s

- 27 A 35 kg object released from rest near the surface of a planet falls 7.3 m in 1.5 s. What is the acceleration due to gravity on this planet?
- A 3.1 m/s^2
 - B 6.5 m/s^2
 - C 9.7 m/s^2
 - D 33 m/s^2
- 28 How long would it take a truck to increase its speed from 15 m/s to 35 m/s if it does so with uniform acceleration over a distance of 75 m?
- A 1.5 s
 - B 3.0 s
 - C 3.8 s
 - D 7.5 s
- 29 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
- 30 The train is travelling at 14 m/s [N]. A passenger on a train is walking is at 2 m/s [S]. Which of the following would be correct?
- A ${}_pV_e = 2 \text{ m/s [N]}$
 - B ${}_pV_e = 12 \text{ m/s [N]}$
 - C ${}_pV_e = 16 \text{ m/s [N]}$
 - D ${}_pV_e = 2 \text{ m/s [S]}$
- 31 Duck X is approaching Duck Y at the rate of 10 km/hr. Which of the following is the correct picture for this to occur? (All velocities in the responses are relative to the ground.)

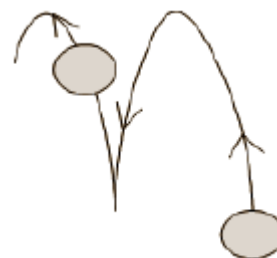


- 32 A barge is heading East at 3.2 m/s relative to the Earth while a person on the barge is walking North at 1.2 m/s, with respect to the barge. With respect to the Earth, in what direction is the person travelling?
- A E 21° N
 - B N 21° E
 - C E 22° N
 - D N 22° E
- 33 A river current is running East at 3.0 m/s. You can paddle your canoe at 4.0 m/s relative to the water. Which of the following vector diagrams correctly shows the heading of your canoe, if you wish to paddle from the North bank to the South bank in a North-South line? (South is down the page.)



- 34 What is meant by a frame of reference?
- A A place for comparing forces
 - B A place from which motion is observed
 - C A vector addition diagram
 - D The gravitational field of the earth

- 35 Your friend is bouncing a ball vertically on the floor of a flatbed truck that is moving at a fixed speed to the left. If you see the motion of the ball as shown in the picture, which of the following locations is your frame of reference?
- A in the cab looking in the rear-view mirror.
 - B on the flat bed with your friend.
 - C on the ground as the truck passes.
 - D travelling broadside with the truck on your motor cycle.

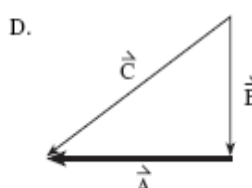
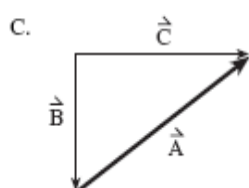
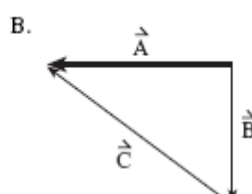
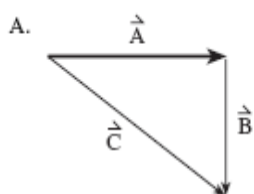


- 36 A student adds two displacement vectors with magnitudes of 3.0 m and 4.0 m, respectively. Which one of the following could not be a possible choice for the resultant?
- A 1.3 m
 - B 3.3 m
 - C 5.0 m
 - D 7.8 m

- 37 Which vector is the opposite of 200 m [E 30° S]?
- A 200 m [S 30° E]
 - B 200 m [N 30° W]
 - C 200 m [W 30° N]
 - D 200 m [W 60° N]

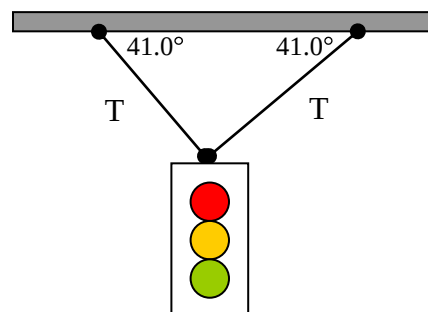
- 38 A hiker walks 3.0 m east and then 4.0 m south. What is the displacement of the hiker?
- A 5.0 m [36.9° South of East]
 - B 5.0 m [53.1° South of East]
 - C 7.0 m [36.9° South of East]
 - D 7.0 m [53.1° South of East]

- 39 Which of the following vector diagrams shows $\vec{A}$ as the sum of $\vec{B}$ and $\vec{C}$ (i.e. $\vec{A} = \vec{B} + \vec{C}$)?

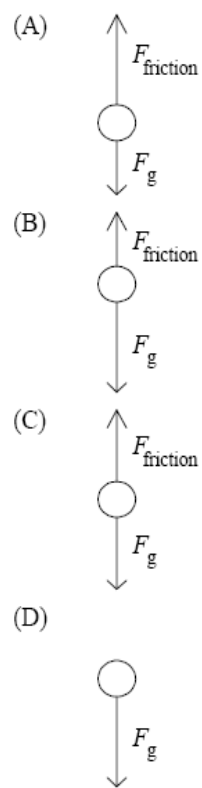


- 40 Which branch of physics studies how objects move?
- A dynamics
 - B equilibrium
 - C kinematics
 - D statics

- 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 Suppose that you were transported to a planet where the value of g was double the value here on Earth. Which statement would be correct?
- A Your mass and weight would both be one-half as much.
 - B Your mass would be one-half as much and weight would be the same.
 - C Your mass would be the same and weight would be twice as much.
 - D Your mass would be the same and weight would be one-half as much.
- 43 Which of the following is a correct unit for gravitational field strength?
- A N
 - B N/C
 - C N/kg
 - D N/m
- 44 An object has a mass of 67.4 kg. How much does it weigh?
- A 6.88 N
 - B 9.80 N
 - C 67.4 N
 - D 661 N
- 45 If you stand on a bus facing the front as it turns to the left, what direction does your body's inertia cause you to fall?
- A backwards
 - B forwards
 - C to your left
 - D to your right
- 46 The traffic light below has a mass of 25.0 kg. Find the tension, T , in each cable.
- A 123 N
 - B 162 N
 - C 187 N
 - D 373 N

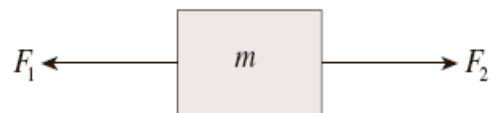


- 47 A Styrofoam ball is falling through the air at terminal velocity. Which free body diagram is the best representation of the event?



- 48 According to Newton's Law of Inertia, what will a piano in the back of a truck tend to do if the truck accelerates away from a stop sign?
- A accelerate at the same rate
 - B accelerate to the rear
 - C move with uniform motion
 - D stay in the same position relative to the ground

- 49 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.
- 50 If the only forces acting on the object shown below are equal in magnitude, which of the following is **not possible**?

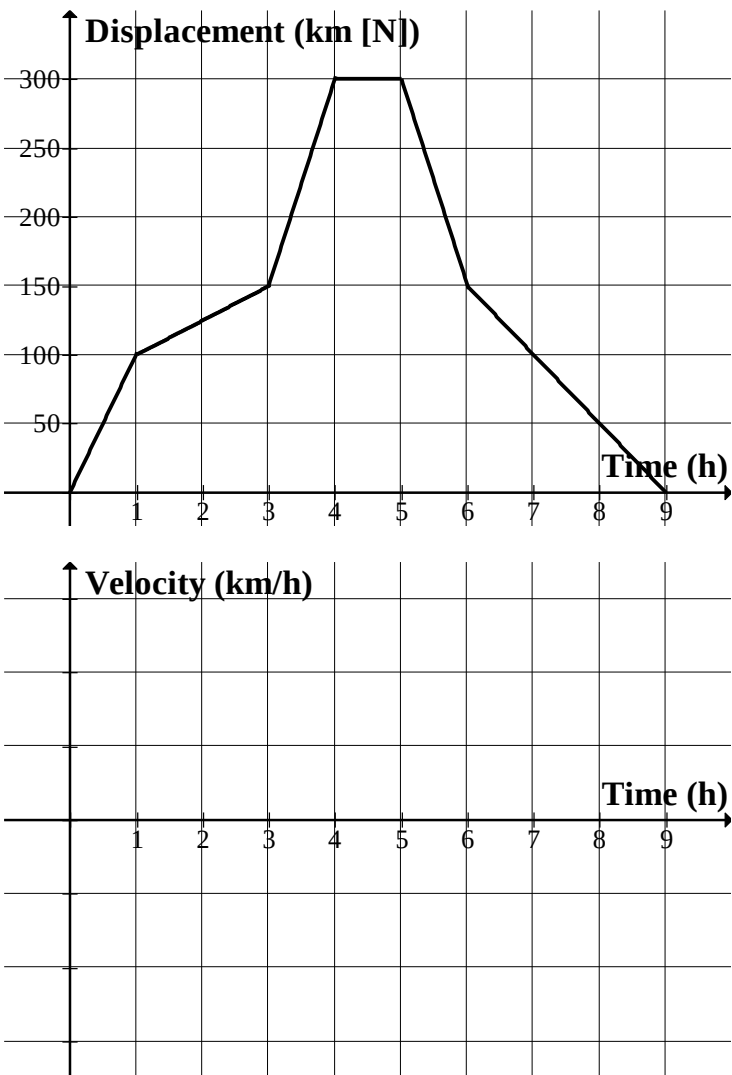


- A The object is at rest.
- B The object is accelerating to the left.
- C The object is moving with constant velocity to the right.
- D The object is moving with constant velocity towards the top of the page.

PART II: Constructed Response
Total Value: 50%

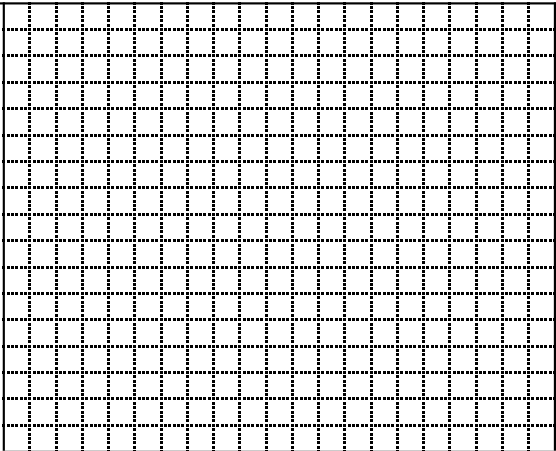
All questions must be attempted in ORDER and numbered properly on the loose leaf provided, EXCEPT 51. Number 51 should be done on the exam. Show ALL necessary steps and calculations as credit may be given for incomplete or partially correct solutions. **Correct answers without calculations will not merit full marks.**

- Value 4% 51. A Construct a velocity versus time graph for the displacement versus time graph given below.



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? (Do on paper provided)

2% 52. A Can an object be accelerating and still be travelling at a constant speed? Explain.

5% A The driver of a Civic traveling 110.0 km/h sees a moose 100.0 m ahead. It takes the driver 0.550 s to apply the brakes and the car slows down at a rate of 8.12 m/s^2 . Calculate whether the car will hit the moose.

4% B Cupid is standing on a balcony that is 30.0 m above the ground. He shoots an arrow straight up into the air at a speed of 40.0 m/s. How much time does it take the arrow to hit the ground?

54. An object starts from rest and accelerates at 3.0 m/s^2 for 4.0 s. Its velocity remains constant for 7.0 s, and it finally comes to rest with a uniform acceleration in another 5.0 s.

2% A What is the speed of the object after its initial acceleration?

2% B What is the object’s acceleration for the last 5.0 s of its motion?

4% C What is the total distance that the object travels?

5% 53. Wilderness trails are excellent for jogging. A jogger chooses a trail that is 72 km long and heads [N 25 °W]. The trail that follows is 86 km long and heads [S 55° E]. Determine the displacement of the jogger.

54 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 $4.0 \times 10^2\text{ m}$ wide, how far downstream is Brad when he reaches the opposite bank?

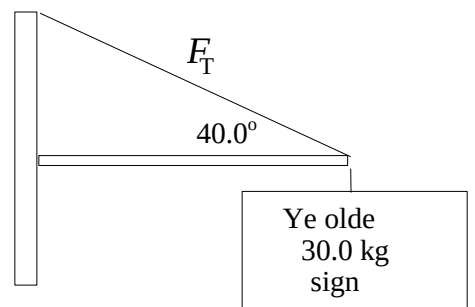
56. A pilot wishes to travel due East relative to the ground. An 85.0 km/h wind is blowing from the North, and the plane has an air speed of 410.0 km/h.

3% A What direction must the pilot head?

2% B What is the velocity of the plane relative to the ground?

2% C How long will it take the plane to fly 1500 km [E]?

3% 57. A) A 30.0 kg sign is hung by a cable held off from the building by a bracket. The cable makes an angle of 40.0° with the horizontal. Determine the force exerted on the cable?



2% B) What is the difference between weight and mass?