

Name: _____

Teacher: _____

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

PHYSICS 2204

SAMPLE EXAMINATION

June 2009

Value: 100%

Time: 2 hours

General Instructions

This examination consists of two parts. Both parts are contained in this booklet and further general instructions are provided on appropriate pages.

Part I – Multiple Choice (40%)

Select the letter of the correct response from those provided. EITHER shade the letter on your computer scorable card OR place the letter in the blank provided on your Multiple Choice Answer Sheet, whichever format is being used by your school for this exam. **Do ALL questions in this section.**

Part II – Constructed Response (60%)

Answer ALL questions fully and concisely in the space provided. Show all work and use correct units and significant digits in all final answers.

A Formulae Sheet is provided.

Student Checklist

The items below are your responsibility. Please ensure that they are completed.

- Write your name and teacher's name on the top of this page.
- Write your name, teacher's name, course name and number on the Part I answer sheet.
- Check the exam to see that there are no missing pages.

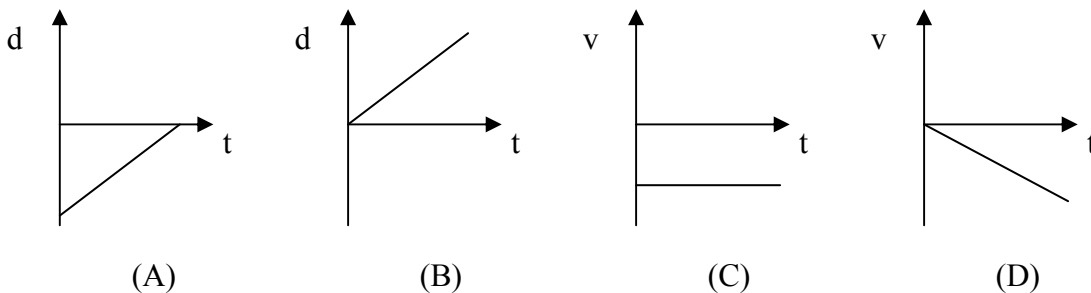
ALL MATERIALS MUST BE PASSED IN WITH THIS EXAM. Use your time wisely. Good luck!

Part I
Total Value: 40%

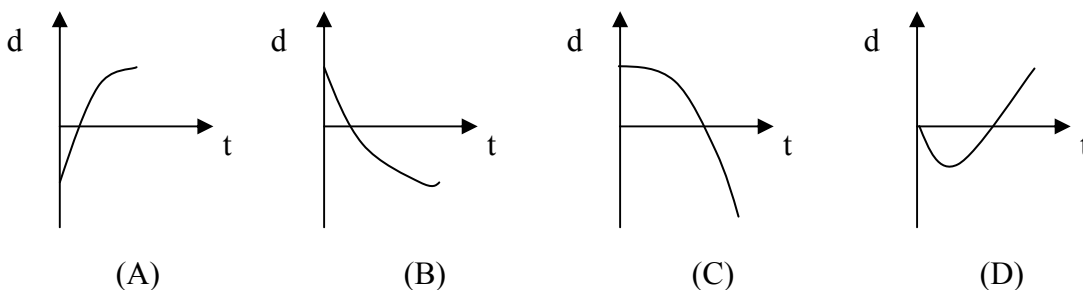
1. Which is true of two vectors whose sum is zero?

	Magnitude	Direction
(A)	different	opposite
(B)	different	same
(C)	same	opposite
(D)	same	same

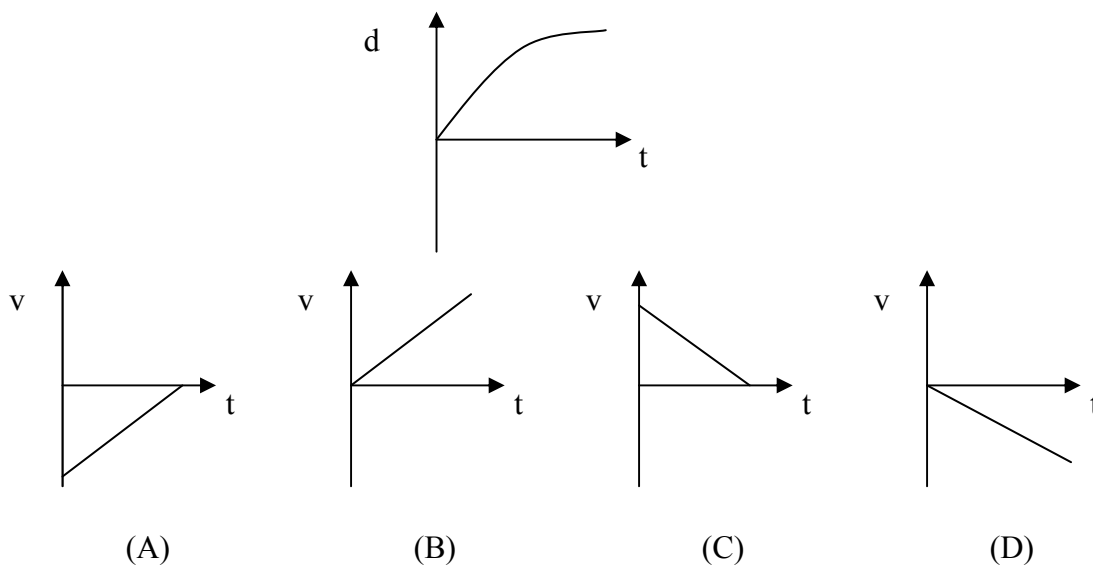
2. Which graph represents an object moving to the left at a constant speed?



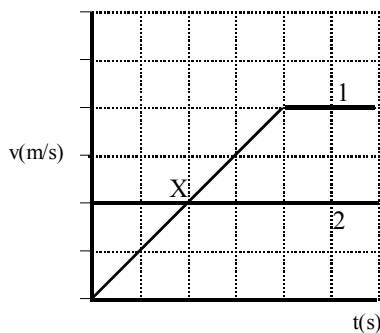
3. Which graph represents an object moving to the right and slowing down?



4. Which velocity-time graph matches the displacement-time graph shown?



5. The velocity of two objects is represented on the graph below. Which is true at point X?



- (A) Both objects have the same acceleration.
- (B) Both objects have the same displacement.
- (C) Object 2 has a greater acceleration than object 1.
- (D) Object 2 has a greater displacement than object 1.

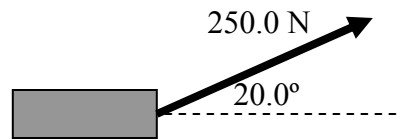
6. How far does an object travel if it starts from rest and accelerates at 2.35 m/s^2 for 2.20 s ?
- (A) 2.59 m
 (B) 5.17 m
 (C) 5.69 m
 (D) 11.4 m
7. How long does it take a car to accelerate from 20.0 m/s to 60.0 m/s at a rate of 8.5 m/s^2 ?
- (A) 0.11 s
 (B) 0.21 s
 (C) 4.7 s
 (D) 9.4 s
8. An object is thrown downwards from the top of a tall bridge with an initial velocity of 12 m/s . What is the speed of the object when it has fallen 9.5 m ?
- (A) 12 m/s
 (B) 14 m/s
 (C) 16 m/s
 (D) 18 m/s
9. Balloon A is moving upwards at 4.8 m/s and balloon B is moving upwards at 1.2 m/s . What is the velocity of balloon A relative to balloon B?
- | | Magnitude | Direction |
|-----|------------------|------------------|
| (A) | 3.6 m/s | [down] |
| (B) | 3.6 m/s | [up] |
| (C) | 6.0 m/s | [down] |
| (D) | 6.0 m/s | [up] |
10. What is the reaction force when a book rests on a table?
- (A) force of book on table
 (B) force of ground on table
 (C) force of table on book
 (D) force of table on ground
11. Which is a measure of an object's resistance to changes in its motion?
- (A) acceleration
 (B) components
 (C) force
 (D) inertia
12. A box of mass 5.00 kg undergoes an acceleration of 3.10 m/s^2 . What is the net force acting on the box?
- (A) 0.620 N
 (B) 1.61 N
 (C) 15.5 N
 (D) 152 N
13. A 0.200 kg puck is fired across the ice with an initial velocity of 18.0 m/s . If it takes 9.00 s to come to a complete stop, what is the magnitude of the net force?
- (A) 0.100 N
 (B) 0.400 N
 (C) 2.00 N
 (D) 4.00 N

14. An object at rest on a table experiences a normal force of 12 N (up). If the maximum static frictional force is 8.0 N, what is the coefficient of static friction between the object and the table?

(A) 0.67
(B) 0.96
(C) 8.0
(D) 96

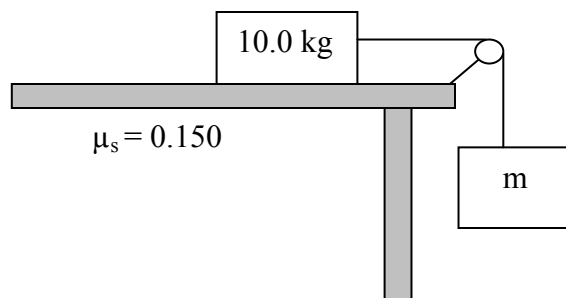
15. A force of 250.0 N is applied to an object at an angle of 20.0° above the horizontal as shown. What is the vertical component of this force?

(A) 0.342 N
(B) 0.940 N
(C) 85.5 N
(D) 235 N



16. A hanging mass, m , is attached to a stationary mass of 10.0 kg on a horizontal table. If the coefficient of static friction between the table and the stationary mass is 0.150, what is the maximum hanging mass that will keep the system at rest?

(A) 1.02 kg
(B) 1.50 kg
(C) 10.0 kg
(D) 66.7 kg



17. Which of Newton's laws best explains how a magician can pull a tablecloth from underneath dishes?

(A) action-reaction
(B) $F = ma$
(C) law of inertia
(D) universal law of gravitation

18. How will the magnitude of the gravitational force, F , between two objects change if one of the masses is doubled and the radius is halved?

(A) $\frac{1}{2} \cdot F$
(B) F
(C) $2 \cdot F$
(D) $8 \cdot F$

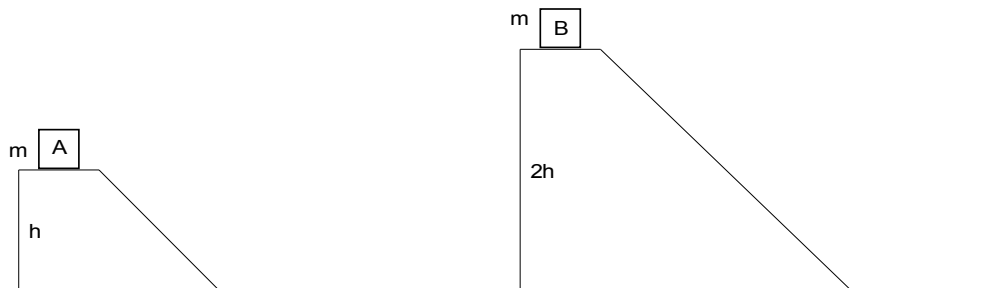
19. Which quantity is defined as the change in an object's momentum?

(A) gravity
(B) impulse
(C) inertia
(D) linear momentum

20. A 100.0 kg canon fires a 20.0 kg ball at a velocity of 45 m/s (E). What is the recoil velocity of the canon?

(A) 0.11 m/s (E)
(B) 0.11 m/s (W)
(C) 9.0 m/s (E)
(D) 9.0 m/s (W)

21. A student exerts a horizontal force of 500.0 N on his friend's chair to move her a distance of 2.0 m across the floor. How much work is done by the student?
- (A) 0 J
 (B) 4.0×10^{-1} J
 (C) 2.5×10^2 J
 (D) 1.0×10^3 J
22. What is the kinetic energy of a 3.0 kg ball that is moving at 2.0 m/s?
- (A) 3.0 J
 (B) 6.0 J
 (C) 12 J
 (D) 18 J
23. Bill's snowmobile is half as powerful as Bonnie's. Both are used to haul identical sled loads of wood across a pond. Which statement is correct?
- (A) Bill's snowmobile will do half as much work as Bonnie's.
 (B) Bill's snowmobile will do the same work as Bonnie's.
 (C) Bill's snowmobile will take twice as long to finish the job as Bonnie's.
 (D) Bill's snowmobile will take the same time to finish the job as Bonnie's.
24. A wheel and axle system is estimated to be 85.0 % efficient. How much work needs to be done on the system if the wheel and axle is to do 125 J of work?
- (A) 40.0 J
 (B) 106 J
 (C) 125 J
 (D) 147 J
25. Which represents the rate of work done?
- (A) efficiency
 (B) force
 (C) power
 (D) work
26. The picture below shows two identical blocks A and B, with mass, m , resting at the top of two hills. If the blocks slid down the hills, how would their speeds compare at the halfway point on each hill? Neglect friction.



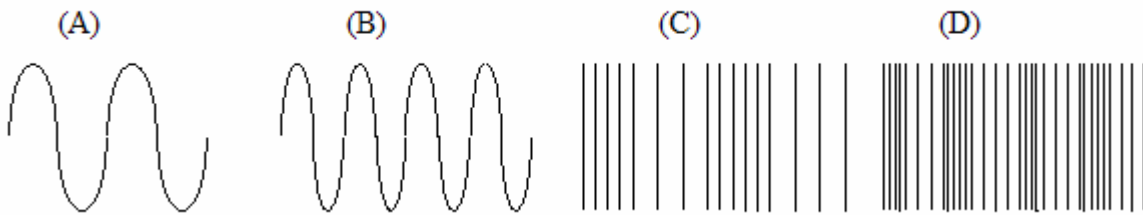
- (A) speed of B is 2 times greater than the speed of A
 (B) speed of B is less than 2 times greater than the speed of A
 (C) speed of B is more than 2 times greater than the speed of A
 (D) speed of B is the same as the speed of A
27. A 2.00 kg cat is on a table 1.00 m above the floor. It jumps up on a shelf 2.00 m above the table. What is the gravitational potential energy of the cat with respect to the floor?
- (A) 19.6 J
 (B) 39.2 J
 (C) 58.8 J
 (D) 78.4 J

28. A spring-loaded plunger is used to launch a 1.0 kg car at 4.0 m/s along a frictionless track. The cart goes up a hill to some maximum height h . Which describes, in order, the energy transformations that occur? (Assume no friction)
- (A) elastic potential \rightarrow gravitational potential \rightarrow kinetic
 (B) elastic potential \rightarrow kinetic \rightarrow gravitational potential
 (C) gravitational potential \rightarrow kinetic \rightarrow elastic potential
 (D) kinetic \rightarrow elastic potential \rightarrow gravitational potential

29. A spring having a spring constant of 180 N/m is stretched 0.51 m from its equilibrium position. How much elastic potential energy does the spring possess?

- (A) 0.043 J
 (B) 23 J
 (C) 46 J
 (D) 94 J

30. Which represents a transverse wave with the longest wavelength?



31. The sound intensity at 1.5 m from a tuning fork is 4.0 W/m^2 . What is the sound intensity at 0.75 m from the tuning fork?

- (A) 1.0 W/m^2
 (B) 2.0 W/m^2
 (C) 8.0 W/m^2
 (D) 16 W/m^2

32. When you push someone in a swing at just the right frequency, the person in the swing moves higher and higher. Which term best describes what is happening?

- (A) diffraction
 (B) interference
 (C) refraction
 (D) resonance

33. A man looks in a plane mirror as he shaves. If his eyes are 4.0 cm from the mirror, how far are his eyes from the image of his eyes?

- (A) 2.0 cm
 (B) 4.0 cm
 (C) 8.0 cm
 (D) 16 cm

34. A periodic wave in a rope has a wavelength of 0.50 m. Two complete waves pass a knot on the rope in 2.0 s. What is the speed of the wave?

- (A) 0.25 m/s
 (B) 0.50 m/s
 (C) 1.0 m/s
 (D) 2.0 m/s

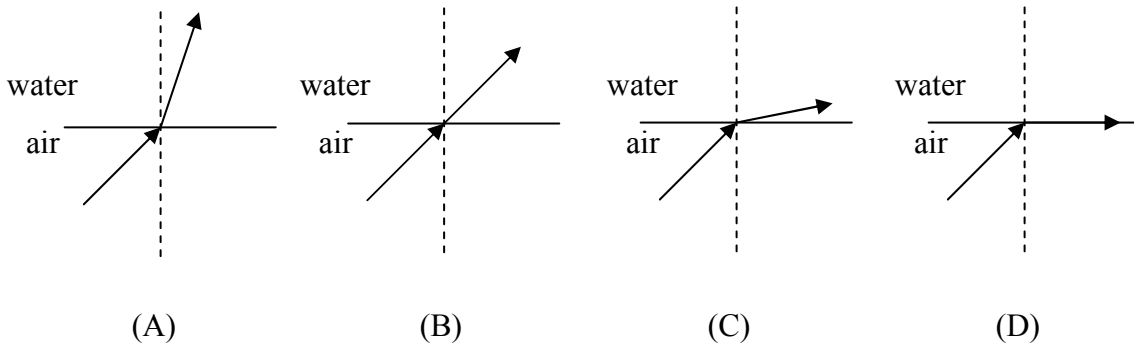
35. What happens as an airplane approaches Mach 1?

- (A) It's speed becomes much greater than the speed of sound.
 (B) It's speed becomes much less than the speed of sound.
 (C) It's speed nears the speed of sound.
 (D) The speed of sound decreases.

36. An observer sees the puff of smoke from a dynamite blast and hears the blast 3.25 s later. If the air temperature is 15.0°C , how far away is the blast?

- (A) 105 m
- (B) 341 m
- (C) 1080 m
- (D) 1110 m

37. Which shows how light moves from air into water?



38. Two tuning forks struck at the same time produce a beat frequency of 4.0 Hz. If the frequency of one of the forks is 329 Hz, what is the minimum frequency of the second fork?

- (A) 0 Hz
- (B) 82 Hz
- (C) 325 Hz
- (D) 333 Hz

39. Light enters a block of material from air at an angle of incidence of 60.0° and the angle of refraction in the material is 30.0° . How does the speed of light in the material compare with the speed of light in air?

- (A) It is 0.500 times as great in the material
- (B) It is 0.577 times as great in the material
- (C) It is 1.73 times as great in the material.
- (D) It is 2.00 times as great in the material.

40. An empty pop bottle is to be used as a musical instrument in a band. In order to be tuned properly the fundamental frequency of the bottle must be 440.0 Hz. If the bottle is 0.260 m tall, how high should it be filled with water to produce the desired frequency if the speed of sound in air is 343 m/s?

- (A) 0.065 m
- (B) 0.120 m
- (C) 0.195 m
- (D) 0.260 m

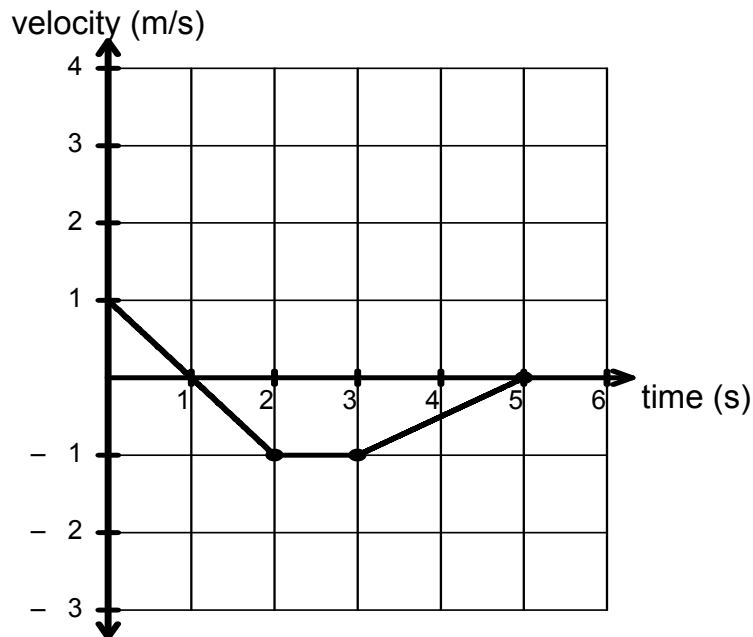
End of Part I

Part II
Constructed Response
Total Value: 60%

Answer ALL questions in the space provided. *Show all workings and report all final answers with correct significant digits and units.*

Value

- 6 41. a) The motion of an object is shown on the velocity-time graph below.

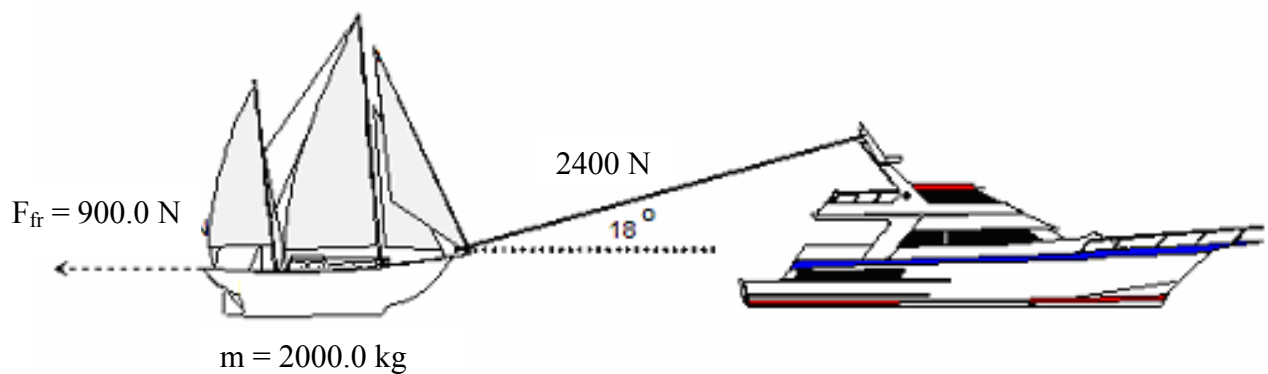


- (i) What is the velocity of the object at $t = 1$ s?
- (ii) What is the magnitude of the acceleration of the object at $t = 4$ s?
- (iii) What is the displacement of the object between $t = 0$ s and $t = 5$ s?

- 4 b) An aircraft can fly at 275 km/hr in still air. The wind is blowing towards the east at 65 km/hr. If the aircraft flies towards the north, calculate the resulting velocity of the aircraft relative to the ground. Your answer should include a vector diagram.

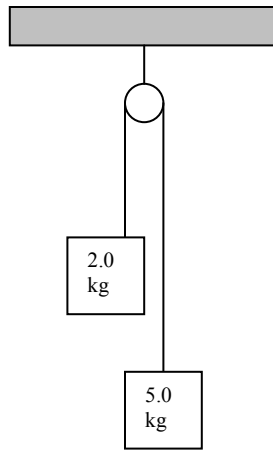
- 4 c) A 65 kg skater is gliding along the ice at a constant speed of 4.00 m/s when he hits a rough patch. The coefficient of kinetic friction between the rough ice and the skate blades is 0.10. Calculate how far the skater will travel on the rough ice before stopping.

- 3 42. a) A disabled sailing vessel is under tow as shown. The towline is making an angle of 18° with the horizontal and is supplying a force of 2400 N. If its mass is 2000.0 kg and it is experiencing a horizontal frictional force of 900.0 N, calculate the magnitude of the acceleration of the sailing vessel.



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- b) A 2.0 kg block and a 5.0 kg block are connected by a rope over a frictionless pulley as shown.

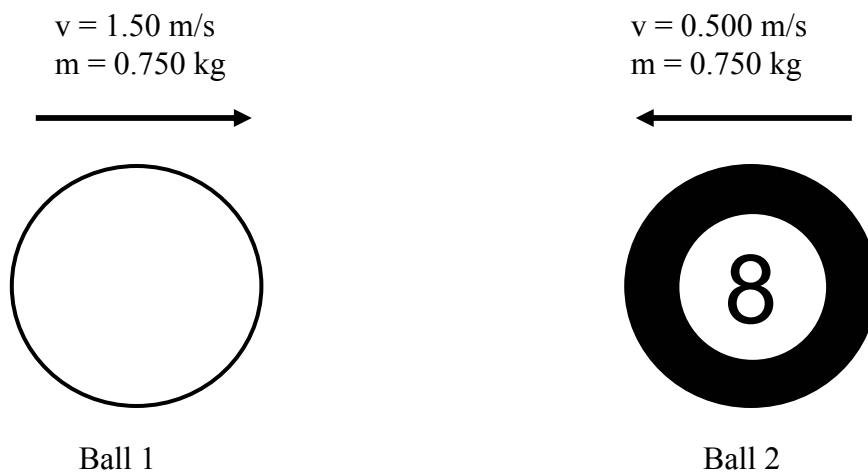


- (i) Calculate the magnitude of the acceleration of the system of blocks.

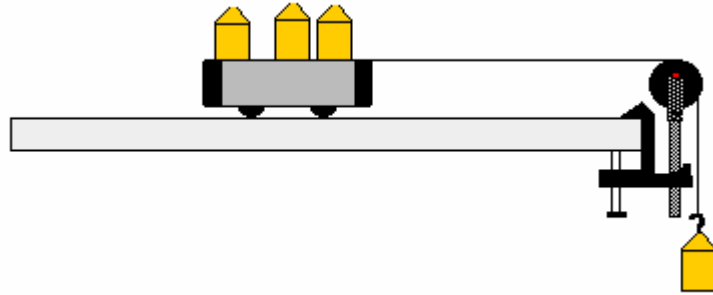
- (ii) Calculate the magnitude of the tension in the connecting rope.

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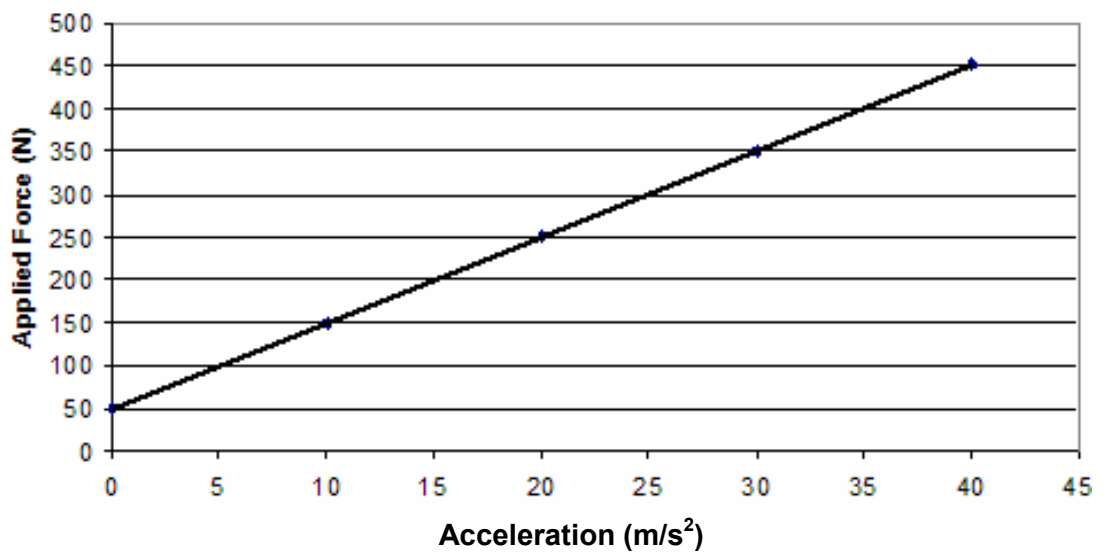
- c) Two pool balls each having a mass of 0.750 kg are approaching each other as shown. Ball 1 is initially traveling at 1.50 m/s to the right while ball 2 is traveling at 0.500 m/s to the left. After the collision, ball 1 is traveling to the right at a speed of 0.35 m/s. Calculate the velocity of ball 2 after the collision.



- 4 d) A mass is attached to a cart as shown, and an experiment is performed to determine the relationship between force, mass and acceleration. For each trial, a mass is taken off the cart and attached to the hanging mass, keeping the total mass of the system constant. A graph of *Applied Force vs. Acceleration* for this experiment is shown below.



Applied Force vs. Acceleration

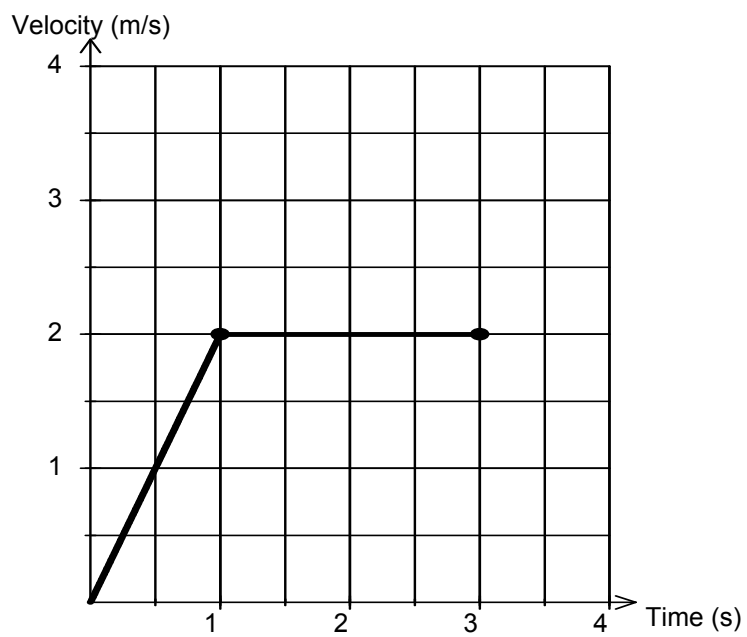
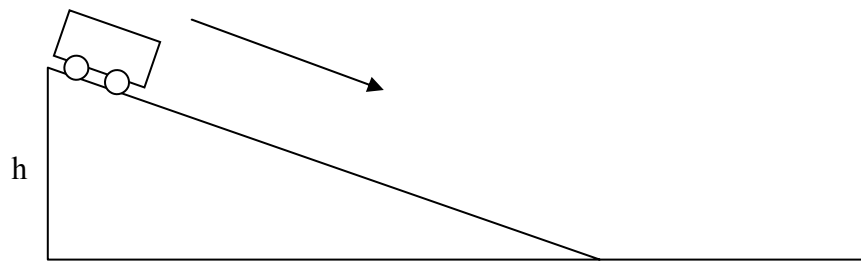


- (i) Calculate the total mass of the system.
- (ii) Determine the frictional force acting on the system.

- 3 43. a) A force of 85 N is applied to a lawn mower at an angle of 60.0° above the horizontal. Calculate the distance the mower must be pushed to do 2000.0 J of work.

- 3 b) A 2.0×10^3 W winch is used to raise a 1200 kg car vertically from a ditch. Calculate how high the car is raised if the winch operates for 72 s.

- 4 c) A 0.500 kg cart is released from rest at the top of a ramp and allowed to roll down the ramp and across a level floor as shown. Data are collected and plotted on the velocity vs. time graph below. Calculate the original height, h , of the ramp.



- 4 d) A spring with a spring constant of 350 N/m is compressed a certain distance by a 3.0 kg mass. If the maximum speed of the mass after it is released is 2.0 m/s, calculate the distance the spring was compressed.

- 3 44. a) An air mattress floating on a lake bobs up and down 45 times in 5.0 minutes. Calculate the speed of the water waves produced if the distance between their crests is 4.0 m.

- 2 b) A single slit of width 1.0×10^{-5} m is illuminated by light of wavelength 6.21×10^{-7} m. Calculate the angle at which the second order minimum occurs.

- 3 c) A police car has a speed trap set up on the highway. The radar gun emits a frequency of 9.0×10^9 Hz and detects waves differing by 1.4×10^3 Hz. Calculate whether the driver of this car will get a speeding ticket if the speed limit is 1.0×10^2 km/h.
- 4 d) The index of refraction for diamond is 2.42.
- (i) If light travels from air into diamond, calculate the speed of light in diamond.
- (ii) Calculate the critical angle for diamond in air.
- 4 e) A standing wave pattern containing three antinodes is produced on a 6.0 m rope.
- (i) Sketch the standing wave pattern produced.
- (ii) Calculate the speed of the wave if the frequency of its source is 5.5 Hz.

End of Part II