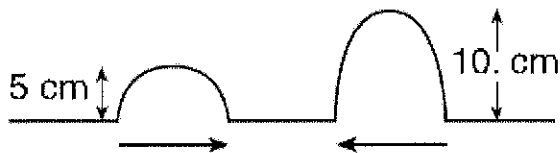


Ultimate Review

Multiple Choice

Identify the choice that best completes the statement or answers the question.

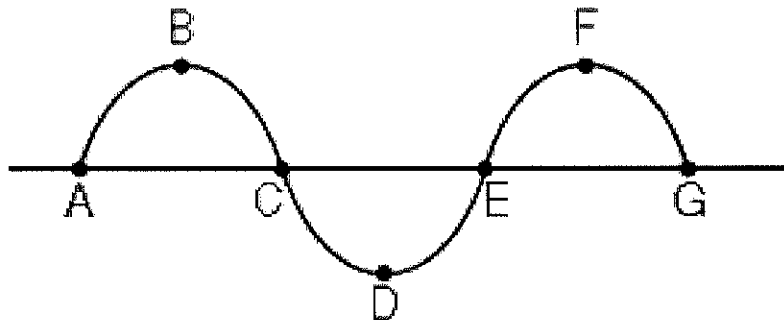
- _____ 1. In which way does blue light change as it travels from diamond into crown glass? **(1 mark)**
- a. Its frequency decreases
 - b. Its frequency increases
 - c. Its speed decreases
 - d. Its speed increases
- _____ 2. The diagram below shows two pulses approaching each other in a uniform medium.



Which diagram best represents the superposition of the two pulses? **(1 mark)**

- a.
- b.
- c.
- d.

- _____ 3. The diagram below represents a transverse wave.



The wavelength of the wave is equal to the distance between points... **(1 mark)**

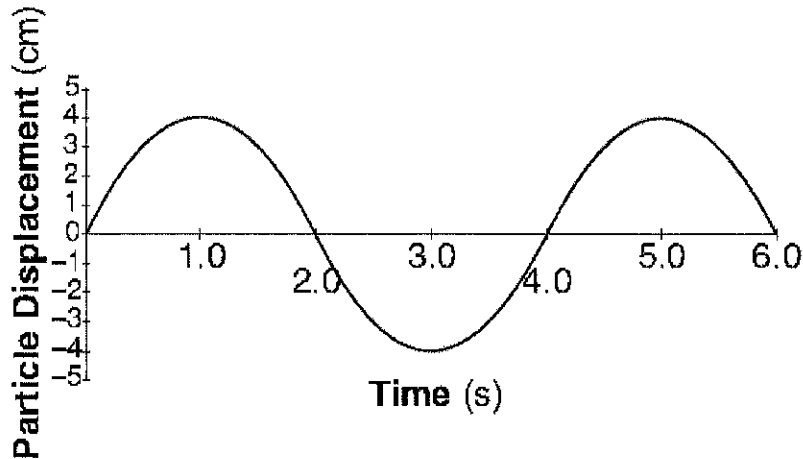
- a. A and C
- b. A and E
- c. A and G
- d. B and D

- ___ 4. The diagram below represents a standing wave.



The number of nodes and antinodes shown in the diagram is

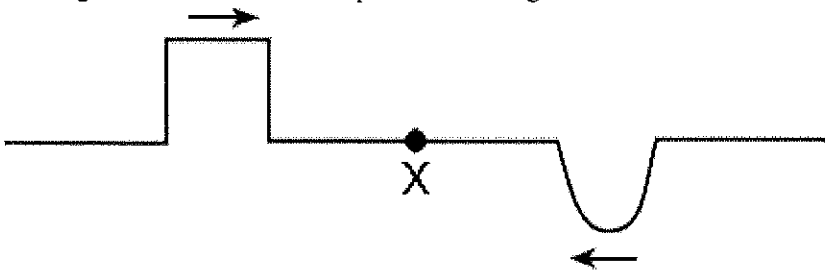
- a. 4 nodes and 5 antinodes
b. 5 nodes and 6 antinodes
c. 6 nodes and 5 antinodes
d. 6 nodes and 10 antinodes
- ___ 5. The graph below represents the displacement of a particle in a medium over a period of time.



The amplitude of the wave is

- a. 4.0 s
b. 6.0 s
c. 8 cm
d. 4 cm
- ___ 6. What is the period of a water wave if 4.0 complete waves pass a fixed point in 10.0 seconds
- a. 0.25 s
b. 0.40 s
c. 2.5 s
d. 4.0 s

7. The diagram below shows two pulses traveling toward each other in a uniform medium.

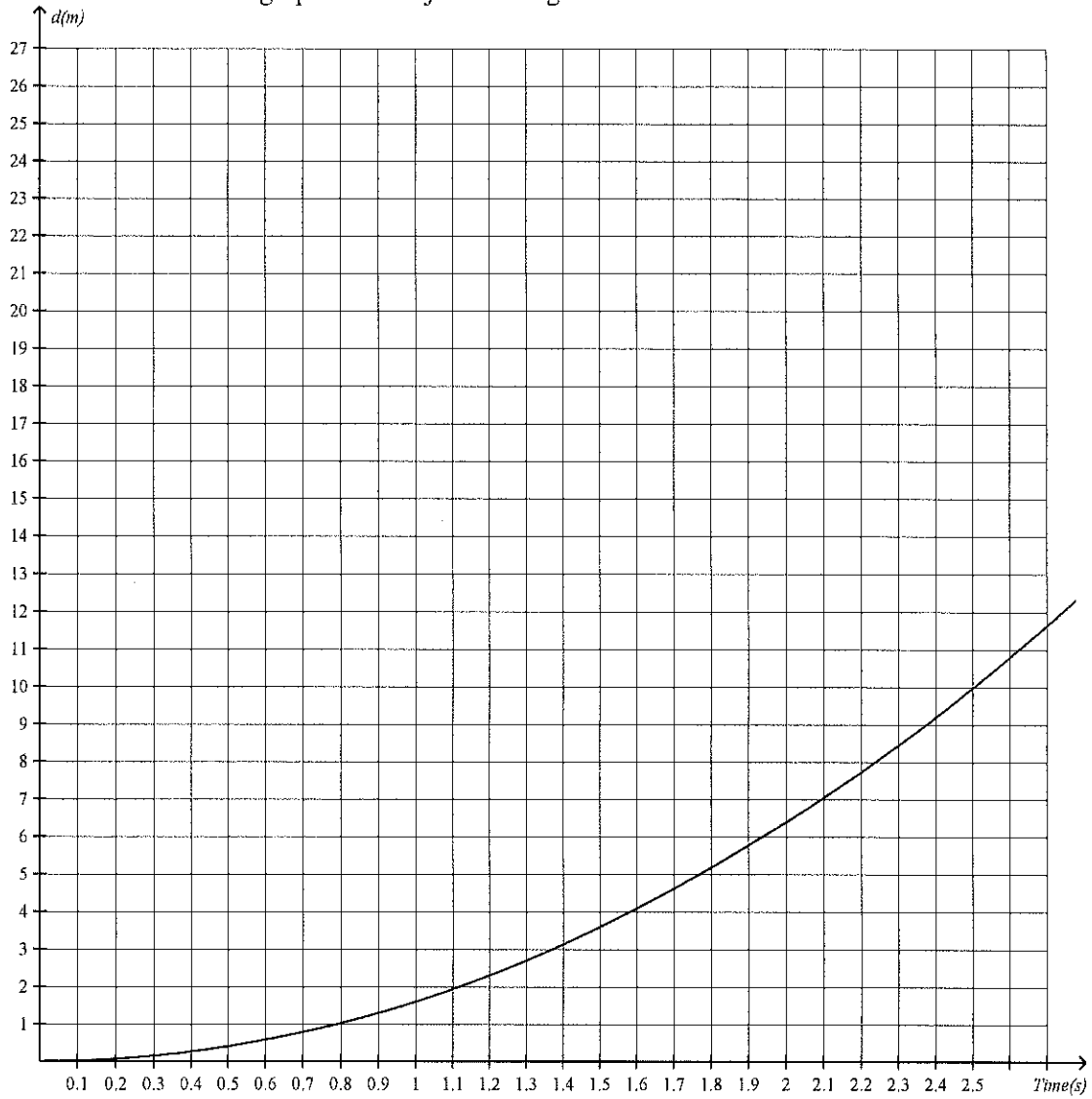


Which diagram best represents the medium when the pulses meet at point X?

- a.
- b.
- c.
- d.

Short Answer

8. Below is a distance-time graph of an object moving.



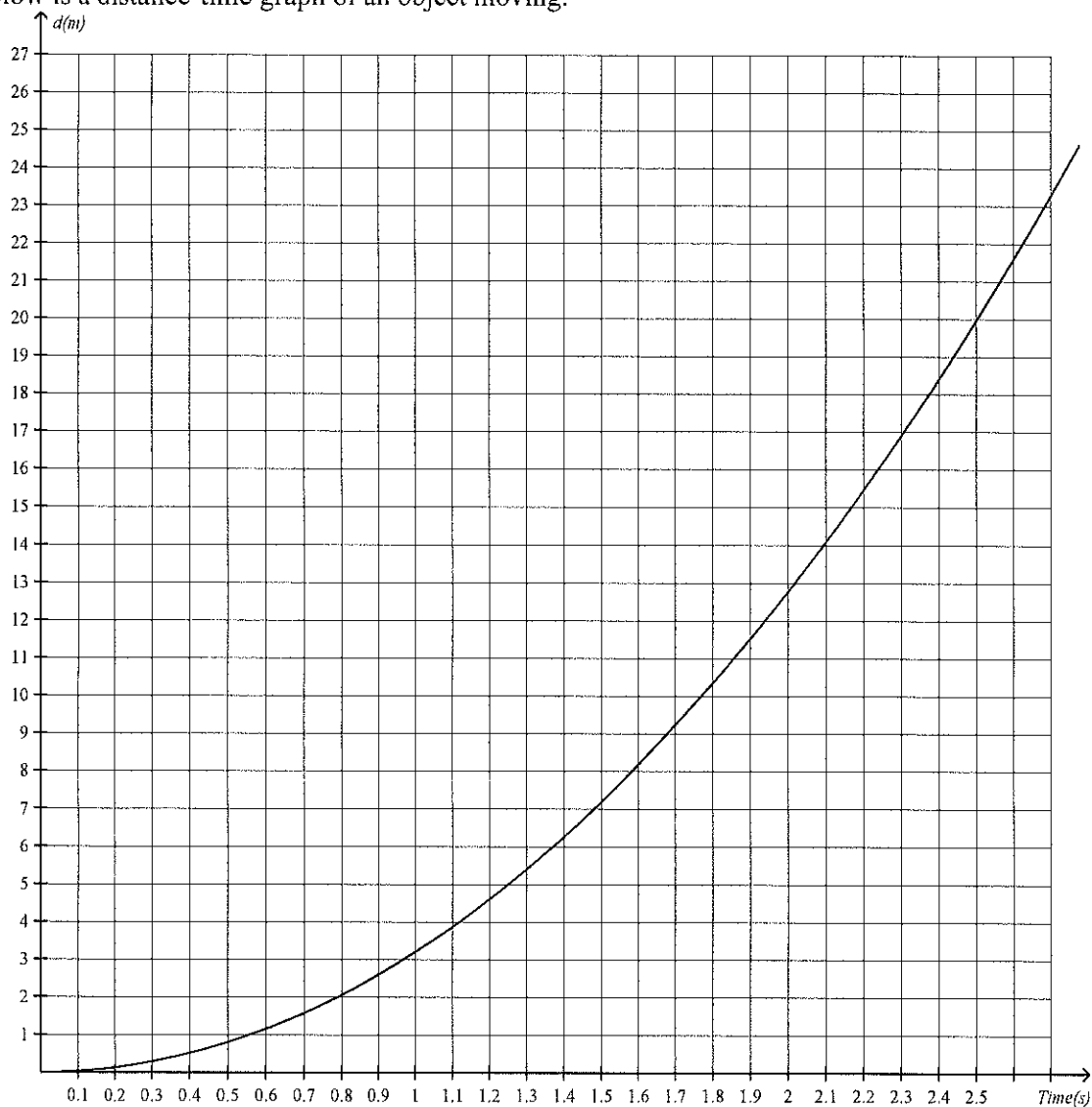
a) Determine the instantaneous velocity at time 1.1s. (1 mark)

ANSWER:

b) How far has the object travelled from 0.9s to 1.5s? (1 mark)

ANSWER:

9. Below is a distance-time graph of an object moving.



a) Determine the instantaneous velocity at time 1.2s. (1 mark)

ANSWER:

b) How far has the object travelled from 1s to 1.6s? (1 mark)

ANSWER:

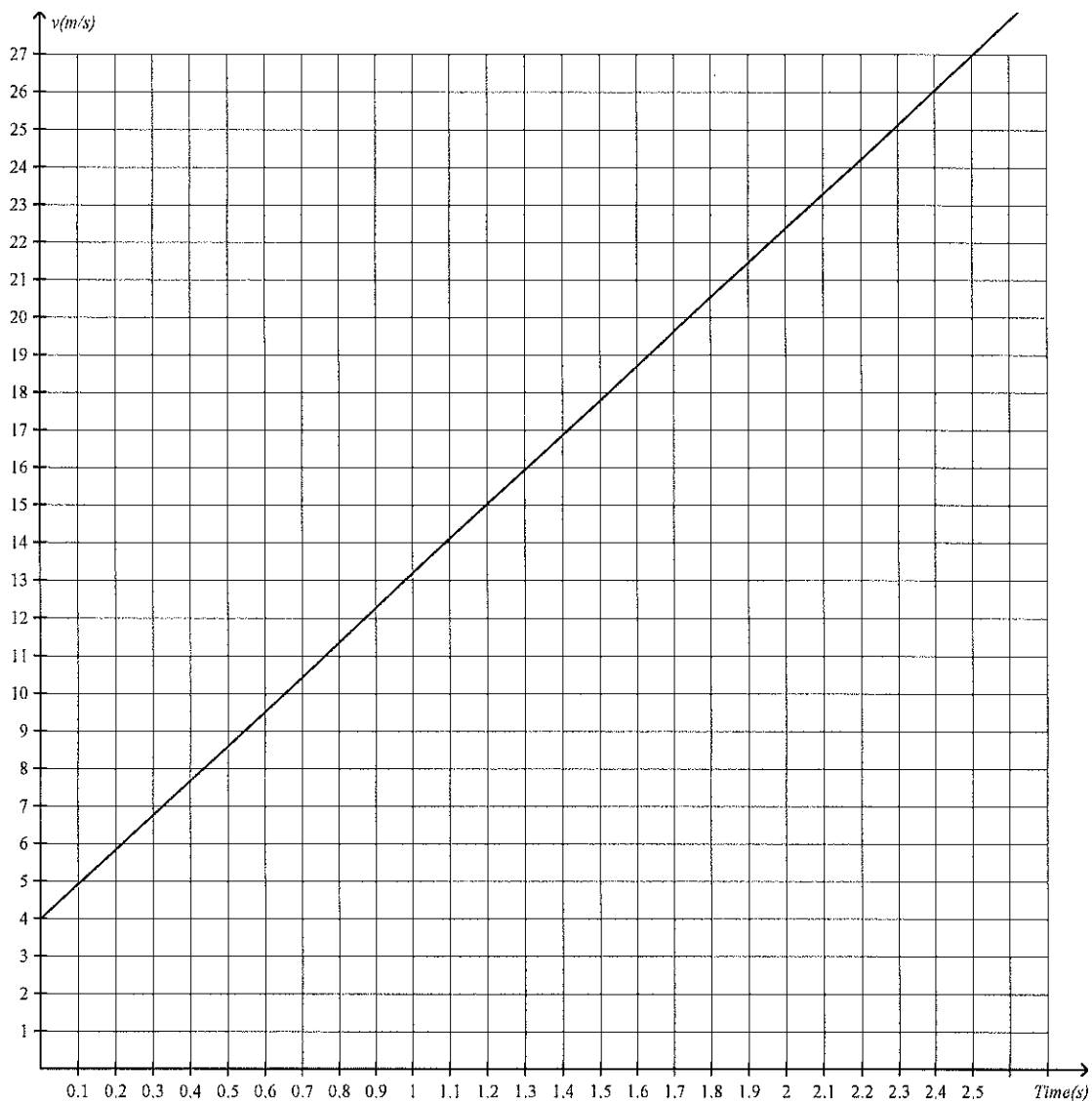
c) What is the average velocity from 0s to 1.6s? (1 mark)

Name: _____

ID: A

ANSWER:

10. Below is a velocity-time graph of a moving object.



From the graph...

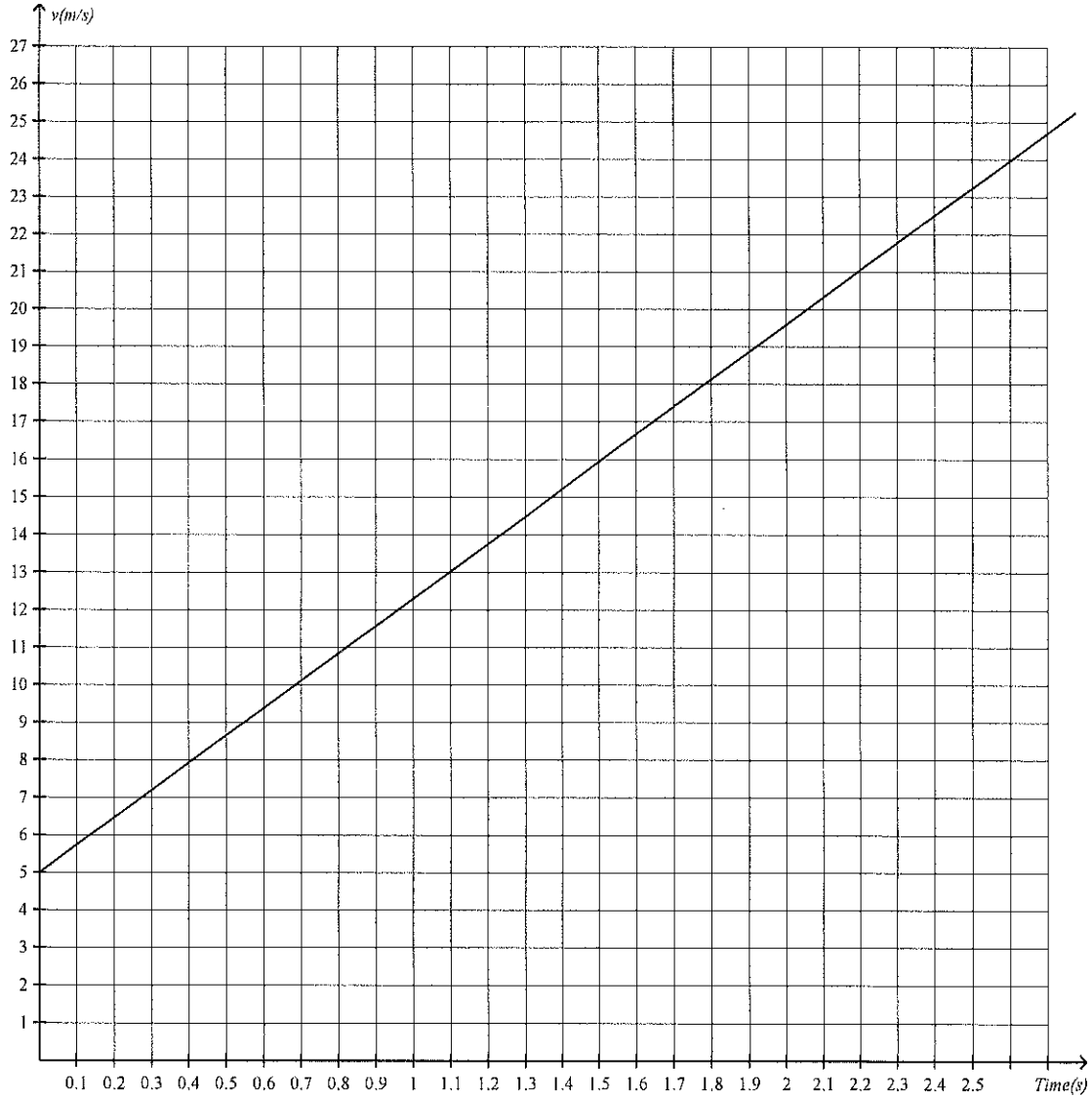
a) Determine the distance travelled up to time 1.3s. (1 mark)

ANSWER:

b) Determine the acceleration of the object. (1 mark)

ANSWER:

11. Below is a velocity-time graph of a moving object.



From the graph...

a) Determine the distance travelled up to time 1.5s. (1 mark)

ANSWER:

b) Determine the average velocity of the object up to time 1.5s. (1 mark)

ANSWER:

12. Tyler leaves the pool at a velocity of 5.5 km/h. After travelling for 34 minutes, Tyler's friend races after Tyler at 8.5 km/h.
- a) How long does it take for the friend to catch up to Tyler? (2 marks)

ANSWER:

- b) How far from the pool are they when Tyler is caught? (1 mark)

ANSWER:

13. Port Hardy is 371 km from Port Albernie. Train A leaves Port Hardy at a velocity of 74 km/h, at 6 am, and train B leaves Port Albernie at a velocity of 82 km/h also at 6 am.
- a) At what time do they pass each other (to the nearest minute)? (2 marks)

ANSWER:

- b) How far from Port Hardy are both trains when they pass each other? (1 mark)

ANSWER:

14. A car starts from rest and travels 415 km in 8.5 hrs. What is the average velocity? (2 marks)

ANSWER:

15. A car starts from rest and travels 240 km in 9.5 hrs. What is the average velocity? (2 marks)

ANSWER:

16. You are going on a 386 km road trip, if you start from rest and travel 58 km/h for 2.3 hours, then stop for a lunch break for 54 minutes, how fast do you need to drive for if you are to have an average velocity of 61 km/h for the entire trip? (3 marks)

ANSWER:

17. You are going on a road trip. First you travel 60 km/h for 1.1 hours, then stop for a fill up for 56 minutes. Then you drive again for 45km at 57km/h. What is your average velocity for the whole trip? (3 marks)

ANSWER:

18. An astronaut breaks the Jupiter high jump record by jumping to a height of 16.6m with a vertical jump of 7.4 m/s. What is the gravitational acceleration on the surface of Jupiter? (3 marks)

ANSWER:

19. What would an astronaut's initial velocity be is they could jump to a height of 12.7m on the Mars. The gravitational acceleration on the surface of Mars is $7.4m/s^2$? (3 marks)

ANSWER:

20. A car traveling at 93.8 m/s applies the brakes and slows down at a constant rate to 24.3 m/s in 563.8 meters.
How long does it take the car to slow down? (3 marks)

ANSWER:

21. A truck is travelling at 10m/s then it accelerates at a rate of $8m/s^2$ for 15s. How far has it travelled in the time it was accelerating? (3 marks)

ANSWER:

22. How high do you have to be to drop a rock so that it hits the ground in 19.2 seconds? (3 marks)

ANSWER:

23. A ball is dropped off a building and 2.3 seconds later a second ball is thrown upwards at 5.4 m/s. How far apart are the balls when the second ball is moving at -29.7 m/s? (3 marks)

ANSWER:

24. A math book is dropped off a building and 5.1 seconds later a second math book is thrown upwards at 2.2 m/s. How far apart are the math books when the second math book has fallen to -37 m? (3 marks)

ANSWER:

25. A projectile is fired straight up with an initial velocity of 17.8 m/s. If air resistance is negligible, how much time elapses before the projectile reaches its maximum height? (3 marks)

ANSWER:

26. A boy is standing on the edge of a 42 m cliff and he throws a ball straight up with an initial velocity of 14.7 m/s. If air resistance is negligible, how fast is the ball moving when it is 8.3 m below the edge of the cliff? (3 marks)

ANSWER:

27. A car traveling at 24 m/s speeds up going down a hill, and is moving at a rate of 66 m/s 46.5 seconds later.

a) What is the rate of acceleration? (2 marks)

ANSWER:

b) How far has the car in traveled in the 46.5 seconds? (2 marks)

ANSWER:

28. An archer standing on a 29 m high wall fires an arrow horizontally at a rate of 20 m/s. How close to the wall can the enemy get before getting hit in the toes by arrows? (3 marks)

ANSWER:

29. A rock is thrown horizontally off a cliff of height 53 m at a velocity of 6 m/s. How far from the base of the cliff does it land? (3 marks)

ANSWER:

30. A rock is thrown horizontally off a cliff at a velocity of 10 m/s. If it lands 43 m from the base of the cliff, how high is the cliff? (3 marks)

ANSWER:

31. A rock is thrown horizontally off a cliff of height 48 m and lands 25m from the base of the cliff. How fast was it moving when it was thrown off the cliff? (3 marks)

ANSWER:

32. A prisoner wants to jump over the 3.3 m fence that is 15 m away from the edge of the 20 m high prison building.

a) What is the minimum velocity the prisoner needs to run to just clear the fence? (3 marks)

ANSWER:

b) What is the prisoner's vertical velocity when he hits the ground? (2 marks)

ANSWER:

Name: _____

ID: A

33. A prisoner who can run at 6.6m/s , wants to jump over the 4.5 m fence that is 13 m away from the edge of a prison building.
- a) What is the minimum height the building needs to be so the prisoner will just clear the fence? (3 marks)

ANSWER:

- b) What is the prisoner's vertical velocity when he hits the ground? (2 marks)

ANSWER:

34. Mr. Roome is dropping water-balloons on students as they pass under an over-head-walkway. If he is 20 m above the student's heads and they are walking at a rate of 6.3 m/s , at what horizontal distance before the students pass underneath, should he drop the balloons to get a head-shot? (3 marks)

ANSWER:

35. An airplane is flying along at 400 km/h and at an altitude of 2875 m. An enemy tank is moving towards the plane at 30 km/h. How far from the tank (directly below the plane) should the plane drop the bomb so it hits the tank? (3 marks)

ANSWER:

36. An airplane is flying along at 370 km/h and at an altitude of 2350 m. An enemy tank is moving in the same direction as the plane at 55 km/h. How far from the tank (directly below the plane) should the plane drop the bomb so it hits the tank? (3 marks)

ANSWER:

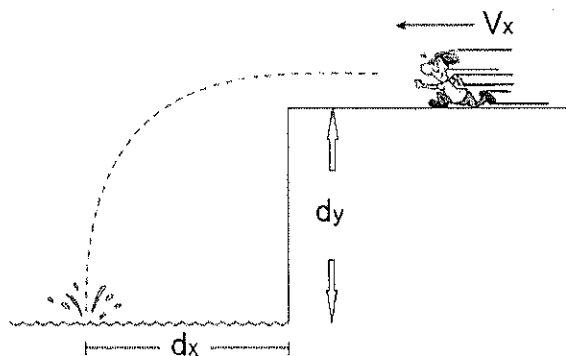
37. What is the gravitational acceleration of a planet if an astronaut runs at a rate of 5.1 m/s off a 98 m hill and lands 16 m from the base of the hill? (3 marks)

ANSWER:

38. How high is a building if a runner running at 9.1 m/s can land 11 m from the base of the building (ignore broken bones or death upon landing)? (3 marks)

ANSWER:

39. Mike runs horizontally off a cliff at 8.4 m/s and lands in the water 10.3 m from the base of the cliff.



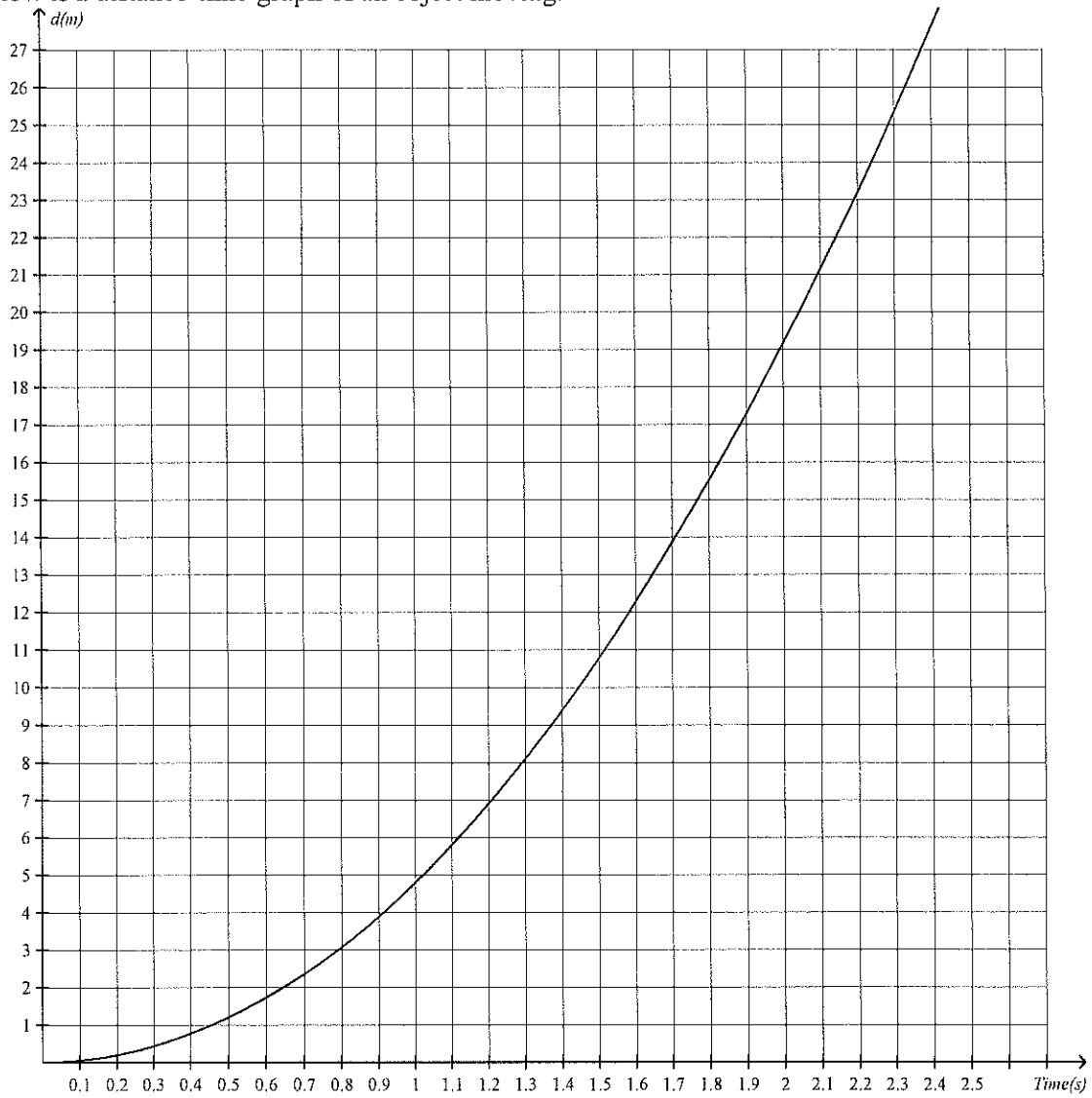
- a) How long does it take Mike to hit the water? (1 mark)

ANSWER:

- b) How high is the cliff? (2 marks)

ANSWER:

40. Below is a distance-time graph of an object moving.



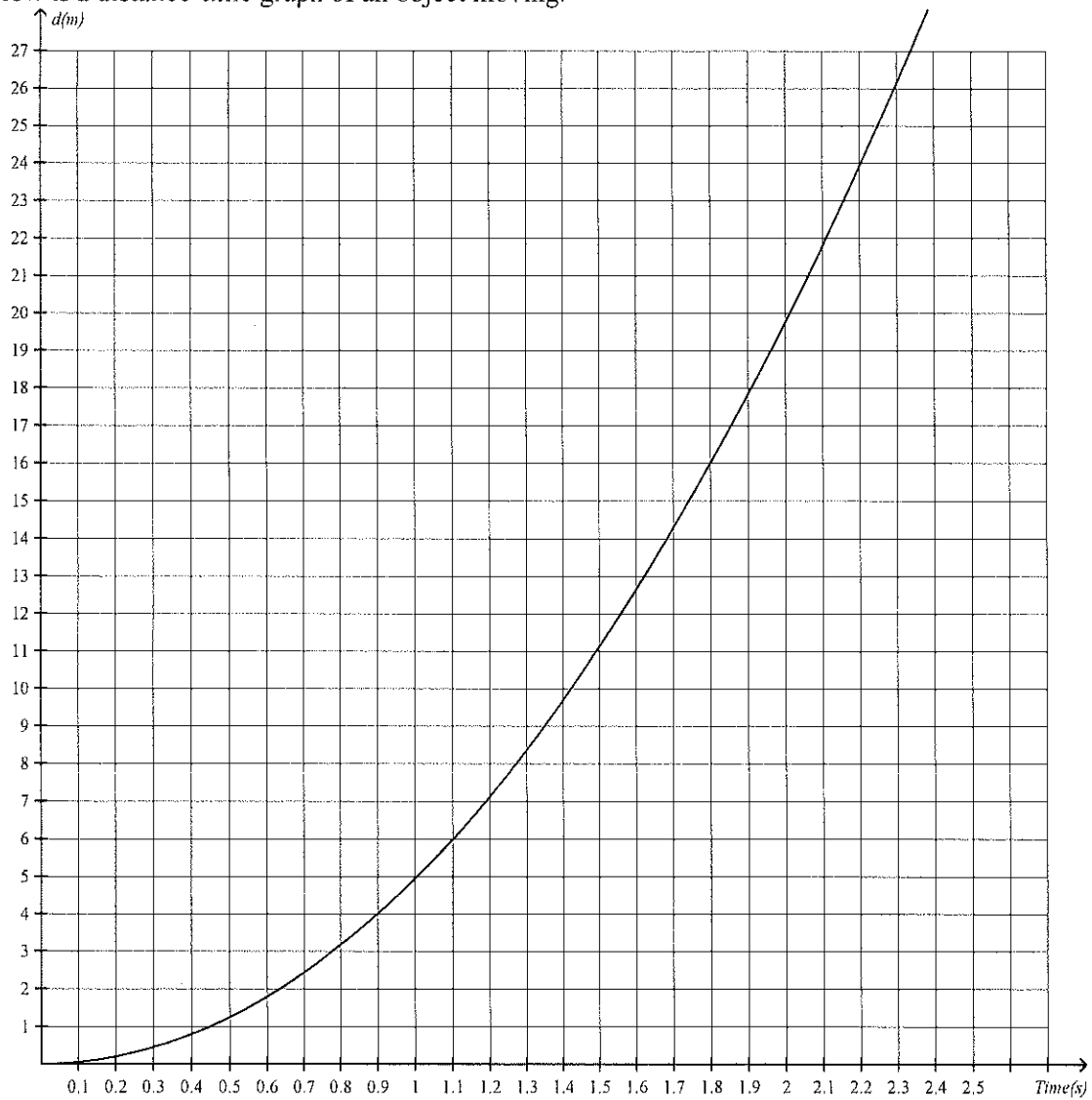
a) Determine the instantaneous velocity at time 1.4s. (1 mark)

ANSWER:

b) How far has the object travelled from 1.2s to 1.8s? (1 mark)

ANSWER:

41. Below is a distance-time graph of an object moving.



a) Determine the instantaneous velocity at time 1.6s. (1 mark)

ANSWER:

b) How far has the object travelled from 1.4s to 2s? (1 mark)

ANSWER:

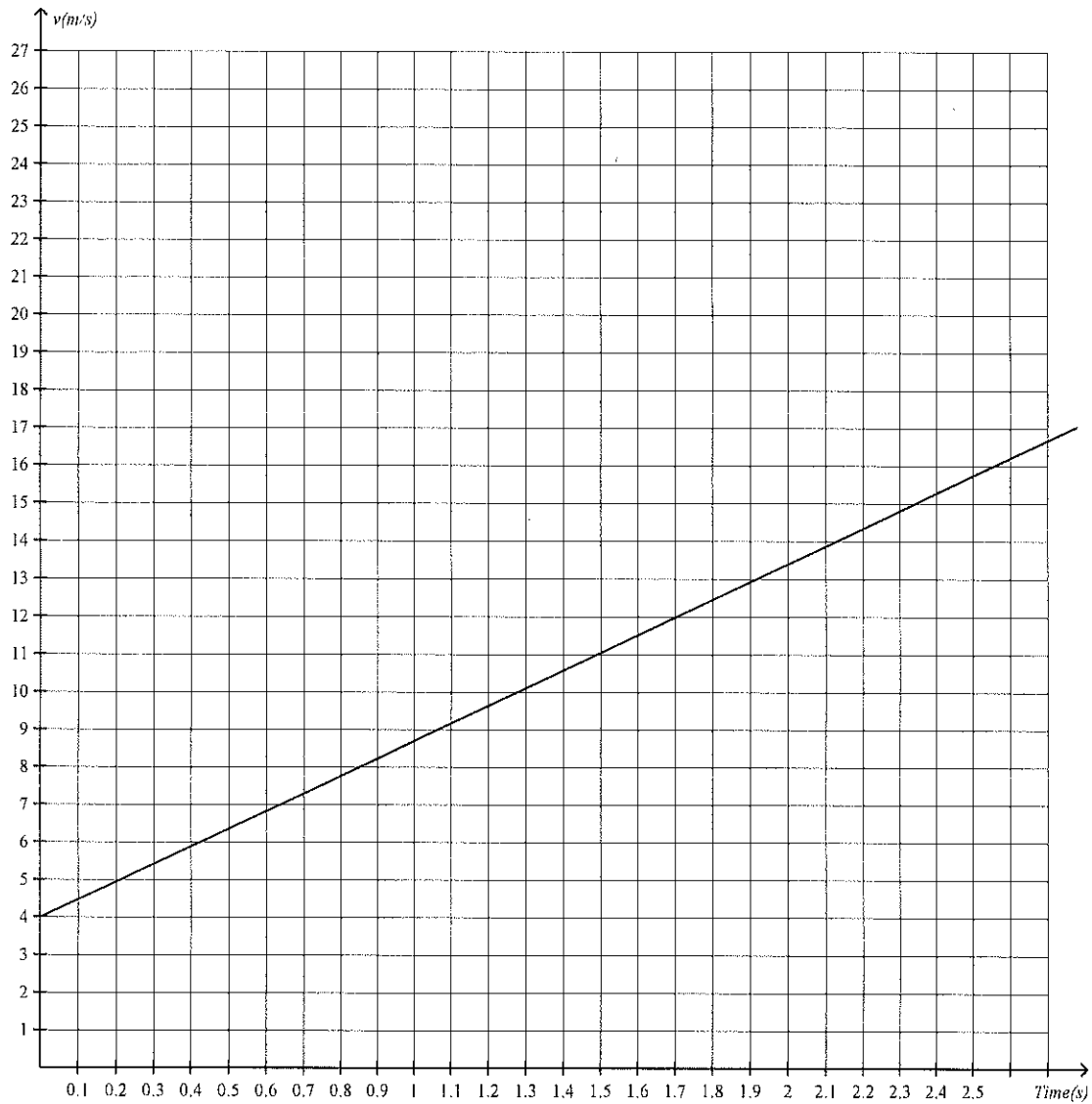
c) What is the average velocity from 0s to 2s? (1 mark)

Name: _____

ID: A

ANSWER:

42. Below is a velocity-time graph of a moving object.



From the graph...

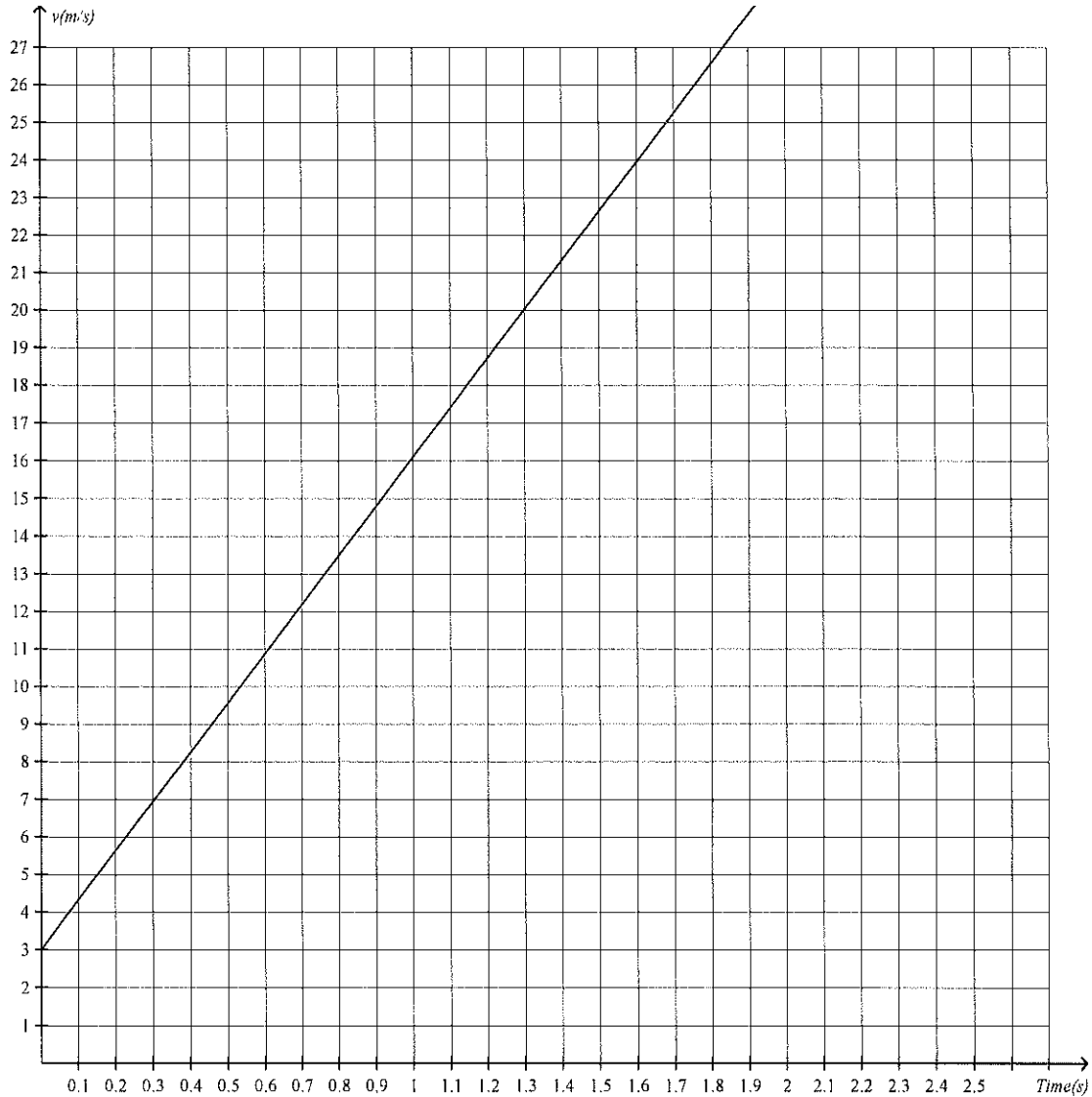
a) Determine the distance travelled up to time 1.5s. (1 mark)

ANSWER:

b) Determine the acceleration of the object. (1 mark)

ANSWER:

43. Below is a velocity-time graph of a moving object.



From the graph...

a) Determine the distance travelled up to time 0.9s. (1 mark)

ANSWER:

b) Determine the average velocity of the object up to time 0.9s. (1 mark)

ANSWER:

44. Dejan leaves home at a velocity of 3.5 km/h. After travelling for 101 minutes, Dejan's friend races after Dejan at 7.5 km/h.

a) How long does it take for the friend to catch up to Dejan? (2 marks)

ANSWER:

b) How far from home are they when Dejan is caught? (1 mark)

ANSWER:

45. Courtenay is 206 km from Comox. Train A leaves Courtenay at a velocity of 69 km/h, at 9 am, and train B leaves Comox at a velocity of 80 km/h also at 9 am.

a) At what time do they pass each other (to the nearest minute)? (2 marks)

ANSWER:

b) How far from Courtenay are both trains when they pass each other? (1 mark)

ANSWER:

46. A car starts from rest and travels 200 km in 12.5 hrs. What is the average velocity? **(2 marks)**

ANSWER:

47. A car starts from rest and travels 425 km in 9 hrs. What is the average velocity? **(2 marks)**

ANSWER:

48. You are going on a 118 km road trip, if you start from rest and travel 47 km/h for 1.1 hours, then stop for a restroom break for 30 minutes, how fast do you need to drive for if you are to have an average velocity of 51 km/h for the entire trip? **(3 marks)**

ANSWER:

49. You are going on a road trip. First you travel 42 km/h for 2.7 hours, then stop for a lunch break for 92 minutes. Then you drive again for 126km at 87km/h. What is your average velocity for the whole trip? **(3 marks)**

ANSWER:

50. An astronaut breaks the Uranus high jump record by jumping to a height of 11.3m with a vertical jump of 7.6 m/s. What is the gravitational acceleration on the surface of Uranus? **(3 marks)**

ANSWER:

51. What would an astronaut's initial velocity be if they could jump to a height of 14.9m on the Neptune. The gravitational acceleration on the surface of Neptune is $2m/s^2$? **(3 marks)**

ANSWER:

52. A truck traveling at 64.7 m/s applies the brakes and slows down at a constant rate to 26.3 m/s in 387.3 meters.
How long does it take the truck to slow down? (3 marks)

ANSWER:

53. A truck is travelling at 22m/s then it accelerates at a rate of 10m/s^2 for 13s. How far has it travelled in the time it was accelerating? (3 marks)

ANSWER:

54. How high do you have to be to drop a rock so that it hits the ground in 17.8 seconds? (3 marks)

ANSWER:

55. A ball is dropped off a building and 3.2 seconds later a second ball is thrown upwards at 3.2 m/s. How far apart are the balls when the second ball is moving at -19.6 m/s? (3 marks)

ANSWER:

56. A physics book is dropped off a building and 4.8 seconds later a second physics book is thrown upwards at 4.3 m/s. How far apart are the physics books when the second physics book has fallen to -92 m? (3 marks)

ANSWER:

57. A projectile is fired straight up with an initial velocity of 5.2 m/s. If air resistance is negligible, how much time elapses before the projectile reaches its maximum height? (3 marks)

ANSWER:

58. A boy is standing on the edge of a 32 m cliff and he throws a ball straight up with an initial velocity of 16.5 m/s. If air resistance is negligible, how fast is the ball moving when it is 6.6 m below the edge of the cliff? (3 marks)

ANSWER:

59. A car traveling at 10 m/s speeds up going down a hill, and is moving at a rate of 47 m/s 34.5 seconds later.
- a) What is the rate of acceleration? (2 marks)

ANSWER:

- b) How far has the car in traveled in the 34.5 seconds? (2 marks)

ANSWER:

60. An archer standing on a 78 m high wall fires an arrow horizontally at a rate of 14 m/s. How close to the wall can the enemy get before getting hit in the toes by arrows? (3 marks)

ANSWER:

61. A rock is thrown horizontally off a cliff of height 68 m at a velocity of 11 m/s. How far from the base of the cliff does it land? (3 marks)

ANSWER:

62. A rock is thrown horizontally off a cliff at a velocity of 8 m/s. If it lands 35 m from the base of the cliff, how high is the cliff? (3 marks)

ANSWER:

63. A rock is thrown horizontally off a cliff of height 100 m and lands 36m from the base of the cliff. How fast was it moving when it was thrown off the cliff? (3 marks)

ANSWER:

64. A prisoner wants to jump over the 4.9 m fence that is 5 m away from the edge of the 10 m high prison building.

a) What is the minimum velocity the prisoner needs to run to just clear the fence? (3 marks)

ANSWER:

b) What is the prisoner's vertical velocity when he hits the ground? (2 marks)

ANSWER:

65. A prisoner who can run at 6.7m/s , wants to jump over the 3.3 m fence that is 7 m away from the edge of a prison building.
- a) What is the minimum height the building needs to be so the prisoner will just clear the fence? (3 marks)

ANSWER:

- b) What is the prisoner's vertical velocity when he hits the ground? (2 marks)

ANSWER:

66. Mr. Roome is dropping water-balloons on students as they pass under an over-head-walkway. If he is 14 m above the student's heads and they are walking at a rate of 4.5 m/s , at what horizontal distance before the students pass underneath, should he drop the balloons to get a head-shot? (3 marks)

ANSWER:

67. An airplane is flying along at 250 km/h and at an altitude of 950 m. An enemy tank is moving towards the plane at 50 km/h. How far from the tank (directly below the plane) should the plane drop the bomb so it hits the tank? (3 marks)

ANSWER:

68. An airplane is flying along at 230 km/h and at an altitude of 3800 m. An enemy tank is moving in the same direction as the plane at 35 km/h. How far from the tank (directly below the plane) should the plane drop the bomb so it hits the tank? (3 marks)

ANSWER:

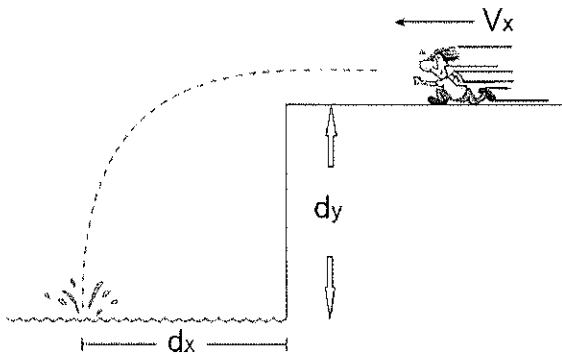
69. What is the gravitational acceleration of a planet if an astronaut runs at a rate of 4.7 m/s off a 31 m hill and lands 5 m from the base of the hill? (3 marks)

ANSWER:

70. How high is a building if a runner running at 5.5 m/s can land 13.5 m from the base of the building (ignore broken bones or death upon landing)? (3 marks)

ANSWER:

71. Mike runs horizontally off a cliff at 5.8 m/s and lands in the water 17.5 m from the base of the cliff.



- a) How long does it take Mike to hit the water? (1 mark)

ANSWER:

- b) How high is the cliff? (2 marks)

ANSWER:

Name: _____

ID: A

$$F_{Net} = ma \quad F_f = \mu F_N \quad F_g = mg \quad F_s = kx$$

$$G = 6.67 \times 10^{-11} \frac{N \cdot m^2}{kg^2} \quad M_{Earth} = 5.98 \times 10^{24} kg \quad R_{Earth} = 6378 km$$

$$F_g = \frac{Gm_1m_2}{d^2} \quad g = \frac{Gm_p}{(r_p)^2}$$

72. If a car weighs 4,470 N on Pluto (gravitational field strength of 0.23 N/kg), what is its weight on Jupiter if the gravitational field strength of Jupiter is 26.85 N/kg. (2 marks)

ANSWER:

73. What is the normal force acting on a 7 kg computer sitting on a table if a person is pushing the computer down with a 20.5 N force? (3 marks)

ANSWER:

74. An elevator is accelerating upwards at a rate of 7.4 m/s². A 88 kg person is standing on a scale inside the elevator. What is the reading on the scale? (3 marks)

ANSWER:

Name: _____

ID: A

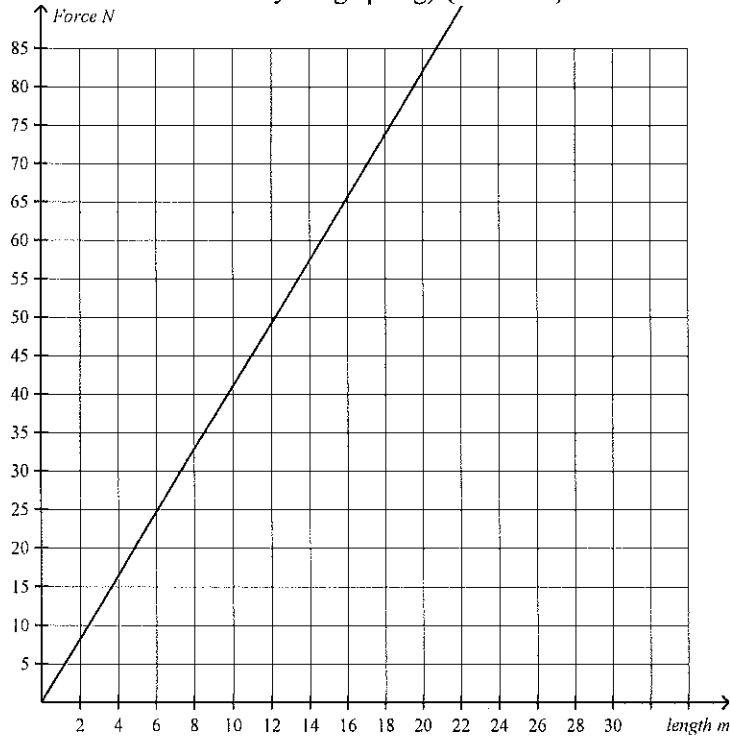
75. What is the coefficient of friction on a 17 kg object that takes 180.4 N of applied force to accelerate it at a rate of 9.2 m/s^2 ? (3 marks)

ANSWER:

76. What is the mass of a block if it stretches a spring 1.6 m with a spring constant of 67 N/m, while pulling a block along at a constant velocity of 3 m/s over a floor with a coefficient of $\mu = 1.2$? (3 marks)

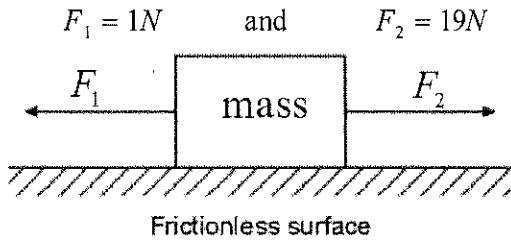
ANSWER:

77. If I applied a force of 153 N to the spring represented in the graph below, how far would it stretch? (There is no elastic limit on this very long spring) (3 marks)



ANSWER:

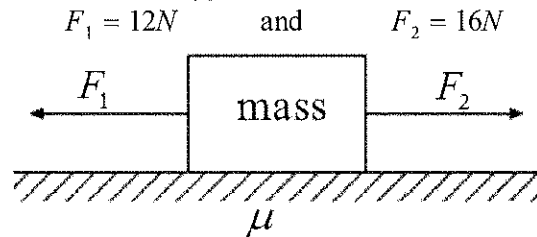
78. Two forces are applied to a 17 kg block on a frictionless horizontal surface ($\mu=0$), as shown in the diagram below.



What is the acceleration of the block and in what direction [left or right]? (3 marks)

ANSWER:

79. Two forces are applied to a 1 kg block on a horizontal surface ($\mu=0.4$), as shown in the diagram below.



What is the acceleration of the block and in what direction [left or right]? (3 marks)
Hint: Determine the direction of movement before you apply the force of friction.

ANSWER:

80. A 88 kg water-skier is accelerated from rest to 14.7 m/s in 2.7 s. If the force of kinetic friction between the skiis and the water surface is 3,676 N, calculate the force of tension in the rope that pulled the skier. (3 marks)

ANSWER:

81. What is the maximum acceleration of a 51 kg astronaut on Jupiter ($g = 7.6 \text{ N/kg}$) can ascend a rope if it has a breaking strength of 472 N? (3 marks)

ANSWER:

82. What is the mass of an object that is accelerated at a rate of 4.5 m/s^2 across a floor that has a coefficient of friction $\mu = 0.3$ when a force of 167 N is applied to the object? (3 marks)

ANSWER:

83. A block of wood of mass 27 kg sliding along a frozen lake at velocity 31 m/s slides onto a rough part of the ice, which exerts a 89 N frictional force on the block of wood.
- a. What is the acceleration of the block of wood? (2 marks)

ANSWER:

- b. How long does it take the block of wood to stop? (2 marks)

ANSWER:

84. If the coefficient of friction between rubber tires and asphalt is $\mu=0.6$. How much distance is needed in order to stop a 740 kg car going at 54 m/s? (3 marks)

ANSWER:

85. A driver in a 2160 kg car is driving along at a rate of 39 m/s. If they see a child run out in front of the car 144 m away, what is the minimum coefficient of friction needed to stop the car before it hits the child? (3 marks)

ANSWER:

Name: _____

ID: A

86. The radius of Mercury is about 2,440 km and its mass is 3.3×10^{23} kg. What would be the Mercury's gravitational force of attraction on a 109 kg astronaut in an orbit 6,680 km **above** the Mercury's surface? (3 marks)

ANSWER:

87. The mass of the Moon is about 7.0×10^{22} kg, and its radius is 1,739 km. What is the acceleration due to gravity on the surface of the Moon?(3 marks)

ANSWER:

88. The mass of the Moon is about 7.0×10^{22} , and the acceleration due to gravity is $1.54 m/s^2$. What is the radius of planet in kilometers? (3 marks)

ANSWER:

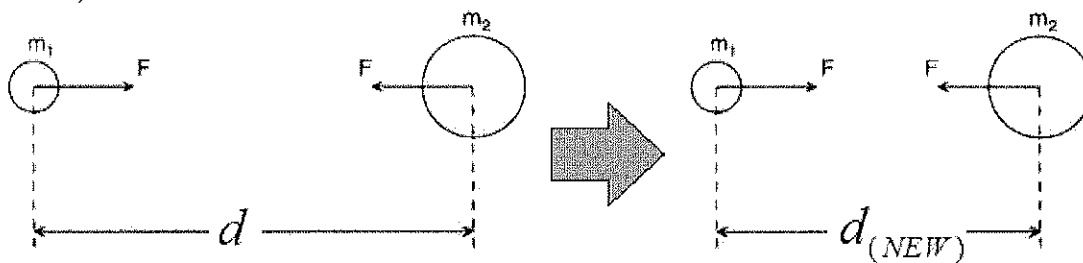
89. A force of 139 N is required to pull a 26 kg wooden block at a constant velocity across a smooth glass surface on Uranus (mass= 8.7×10^{25} kg, radius=25,050 km). What force would be required to pull the same wooden block across the same glass surface of Neptune (mass= 1×10^{26} kg, radius=24700 km) at a constant velocity? (4 marks)

ANSWER:

90. A force of 32 N is required to pull a 21 kg wooden block at a constant velocity across a smooth glass surface on Venus (mass= 4.87×10^{24} kg, radius=6,050 km). What force would be required to pull the same wooden block across the same glass surface of Mars (mass= 6×10^{23} kg, radius=3394 km) with an acceleration of 8 m/s^2 ? (4 marks)

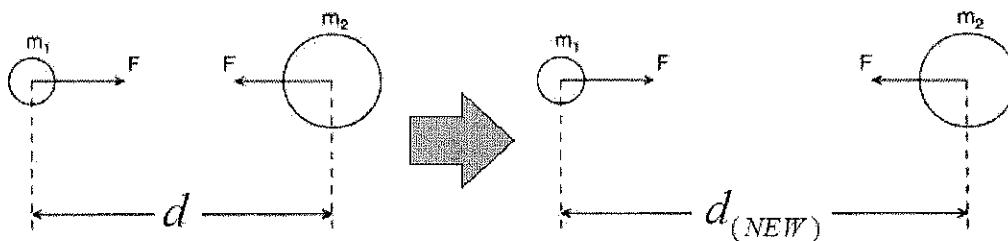
ANSWER:

91. Two masses exert a force of 10 N on each other. They are originally at a distance 'd' apart, and are brought 4 times closer to each other. How much has the force between the two masses increased or decreased? (2 marks)



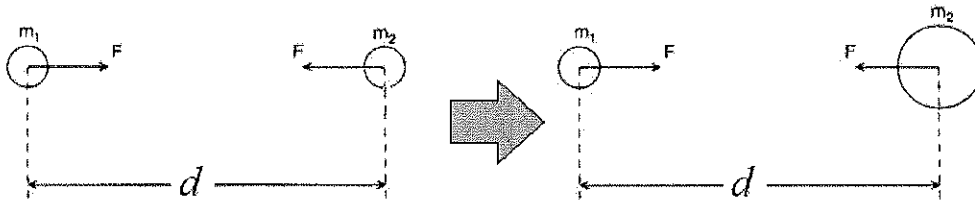
ANSWER:

92. Two masses exert a force of 70 N on each other. They are originally at a distance 'd' apart, and are pulled 10 times farther apart from each other. How much has the force between the two masses increased or decreased? (2 marks)



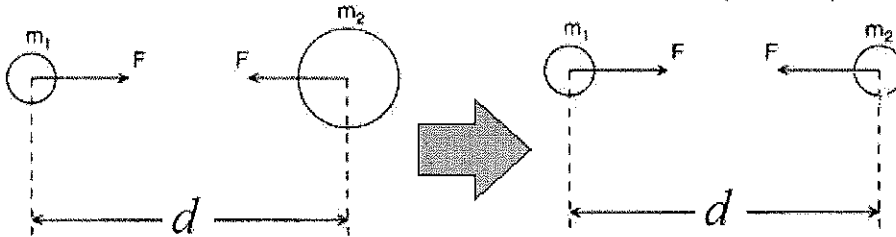
ANSWER:

93. Two masses exert a force of 200 N on each other. The second mass increases in size by 9 times. How much has the force between the two masses increased or decreased? (2 marks)



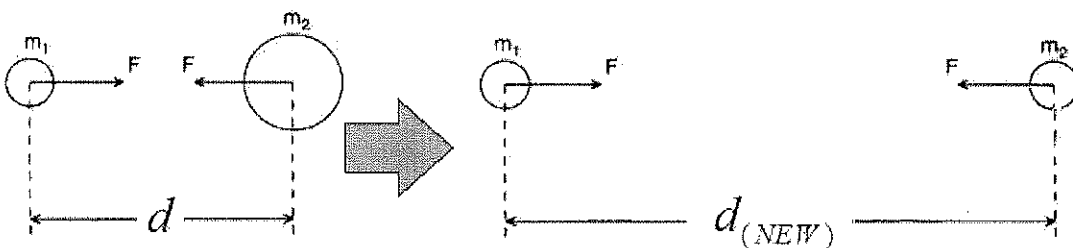
ANSWER:

94. Two masses exert a force of 60 N on each other. The second mass decreases in size by 9 times. How much has the force between the two masses increased or decreased? (2 marks)



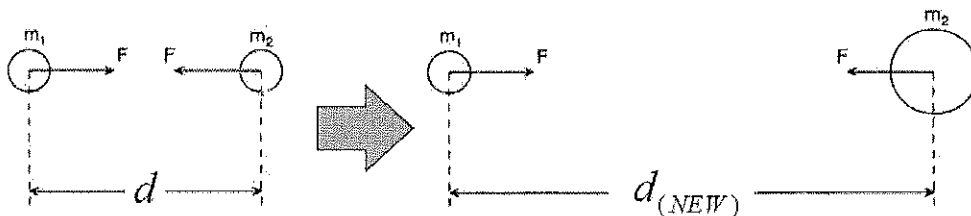
ANSWER:

95. Two masses exert a force of 440 N on each other. The distance between them has increased by 10 times and the second mass decreased in size by 6 times. How much has the force between the two masses increased or decreased? (2 marks)



ANSWER:

96. Two masses exert a force of 920 N on each other. The distance between them has increased by 4 times and the second mass increased in size by 7.5 times. How much has the force between the two masses increased or decreased? (2 marks)



ANSWER:

97. A boy on a bicycle drags a wagon full of newspapers at 10 m/s for 61 minutes using a force of 90 N. How much work has the boy done? (3 marks)

ANSWER:

98. A boy on a bicycle pushes with 22 N on the peddles while doing 184,400 J of work. He rides for 25 minutes. What is his average velocity for the 25 minutes? (3 marks)

ANSWER:

Name: _____

ID: A

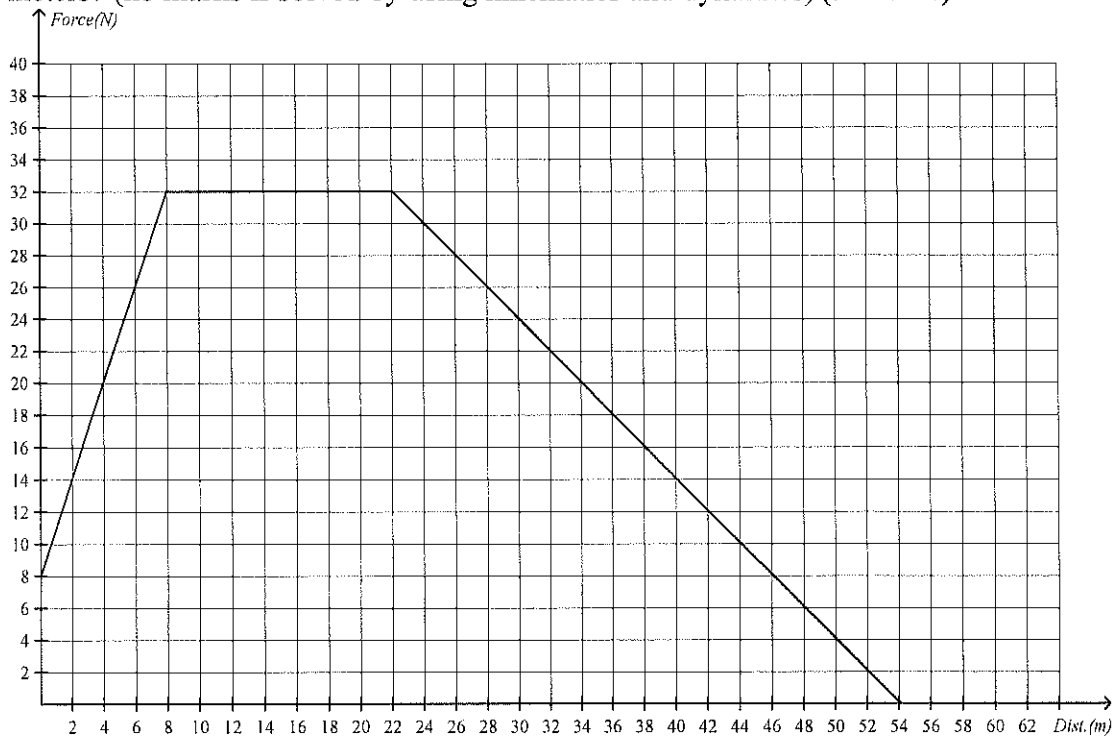
99. A boy on a bicycle pushes with 14 N on the peddles while doing 94,300 J of work. If he is riding a speed of 5.5 m/s, then how long has he been riding in minutes? (3 marks)

ANSWER:

100. If a boy on a bicycle riding at a constant velocity does 70,100 J in 70 minutes and he has applied 36 N during that time then how far has he ridden? (3 marks)

ANSWER:

101. The graph below shows the force applied to an 14 kg object over a total distance of 54 m. The object is already moving at a velocity of 4 m/s. How fast is the 14 kg object moving after being pushed for 54 meters? (no marks if solved by using kinematics and dynamics) (3 marks)



ANSWER:

102. How long will it take a 2,625 W motor to lift a 1545 kg piano to a window 20 m above the ground (assume the motor is 100% efficient)? (3 marks)

ANSWER:

103. How high does a 70% efficient 4 hp motor lift 6 kg in 80 seconds? (1 hp = 746 watts) (3 marks)

ANSWER:

104. How efficient is a 1 hp motor if it can lift a 60 kg object 66 m in 80 seconds? (1 hp = 746 watts) (3 marks)

ANSWER:

105. What hp is a motor rated at if it is 60% efficient and can lift a 25 kg object 90 m in 30 seconds? (1 hp = 746 watts) (3 marks)

ANSWER:

106. A pump is to lift 14 kg of water per minute through a height of 22 m. What output rating (watts) should the pump motor have?(assume the pump is 100% efficient) (3 marks)

ANSWER:

107. In the high jump, the kinetic energy of an athlete is transformed into gravitational potential energy with the aid of a pole. With what minimum speed must the athlete leave the ground in order to clear the bar at a height of 3.1 m and cross the bar with a speed of 1.3 m/s? **(3 marks)**

ANSWER:

108. A student is standing on top of a 28 m cliff and throws their physics book up at 6 m/s. What is velocity of the book, when it is 5 m **below** the edge of the cliff. **(3 marks)**

ANSWER:

109. How efficient is a 4.8 kW heater if it heats a 30 kg block of Aluminum ($c = 878 \text{ J/kg/K}$) from -46°C to 85°C in 17 minutes? **(3 marks)**

ANSWER:

Name: _____

ID: A

110. If you remove 41,700J of heat energy from a 7 kg block of Zinc ($c=388 \text{ J/kg/}^\circ\text{C}$) that is at $24 \text{ }^\circ\text{C}$, what is its final temperature? (3 marks)

ANSWER:

111. How many litres (1 L = 1 kg, but you already knew that) of $98 \text{ }^\circ\text{C}$ water is needed to be added to a 200 L bath at $12 \text{ }^\circ\text{C}$ in order to bring it up to $44 \text{ }^\circ\text{C}$. ($c= 4200 \text{ J/kg/K}$) (3 marks)

ANSWER:

112. Water flows over a section of Niagara Falls at the rate of $3.9 \times 10^6 \text{ kg/s}$ and falls 72 m. What is the power wasted by the waterfall? (3 marks)

ANSWER:

Name: _____

ID: A

113. A 4,900 kg freight car is rolling along a track at -20 m/s [West]. Calculate the time needed for a force of 350 N [East] to make the car go 13 m/s [East] ? (3 marks)

ANSWER:

114. A 4,700 kg freight car is rolling along a track at 20 m/s [East]. Calculate the time needed for a force of -910 N [West] to make the car go 15 m/s [West] ? (3 marks)

ANSWER:

115. A 3,300 kg freight car is rolling along a track at 13 m/s [East]. A force is applied for 16s. Calculate the force and direction of the force to make the freight car go 18 m/s [West] ? (3 marks)

ANSWER:

116. A golf ball at rest of mass 0.34 kg acquires a speed of 132 m/s when hit with a force of 1,540 N. How long was the club in contact with the ball? (3 marks)

ANSWER:

117. A golf ball at rest, acquires a speed of 51 m/s when hit with a force of 3,620 N for 0.008s. What is the mass of the golf ball? (3 marks)

ANSWER:

118. A golfer hits a 0.75 kg golf ball with a force of 3,760 N. The club is in contact with the ball for 0.006 s. How fast does the golf ball leave the tee? (3 marks)

ANSWER:

119. A 14 kg object is moving with a velocity of 14 m/s to the right when it collides with a 16 kg ball heading left at 12 m/s. After the collision, the 14 kg object is moving left at a velocity of 17 m/s. What is the velocity of the 16 kg object after the collision (state direction, left or right)? (3 marks)

ANSWER:

120. A red ball is moving with a velocity of 9 m/s to the right when it collides (but does not stick together) with a 19 kg blue ball heading left at 24 m/s. After the collision, the red ball is moving left at a velocity of 13 m/s. The velocity of the 19 kg blue ball after the collision is 22 m/s to the right. What is the mass of the red ball? (3 marks)

ANSWER:

121. A 15 kg object is moving with a velocity of 21 m/s to the right when it collides with a 19 kg ball heading left at 5 m/s. After the collision the two masses stick together. What velocity do the two objects move off together? (3 marks)

ANSWER:

122. A rocket motor, capable of generating a 155 N·s impulse, is attached to a frictionless 15 kg cart that is already moving at a constant velocity of 3 m/s. The rocket motor is ignited. What will the velocity of the cart be immediately after the rocket motor burns out? (3 marks)

ANSWER:

123. A rocket scientist wants their 17 kg rocket to obtain a final velocity of 630 m/s. How large of an impulse is needed to achieve the required final velocity? **(3 marks)**

ANSWER:

124. If a 7.8 kg gun recoils at a speed of 6.9 m/s, then how heavy must the bullet be if it leaves the gun at a rate of 980 m/s? **(3 marks)**

ANSWER:

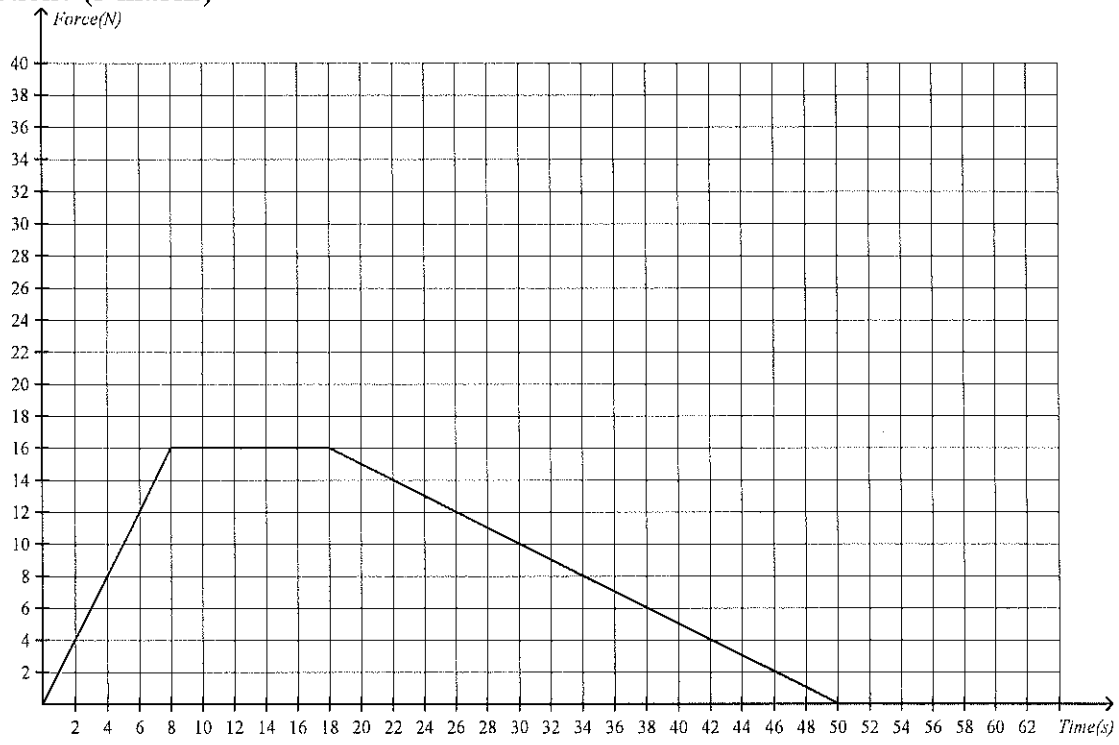
125. A person fires a gun and a 0.07 kg bullet leaves the barrel of the gun at a rate of 920 m/s. If the gun recoils at a rate of 3.6 m/s, then how heavy is the gun? **(3 marks)**

ANSWER:

Name: _____

ID: A

126. A 19 kg model vehicle travelling at 13 m/s [to the right] experiences a push [to the left] for a certain period of time as shown on the graph. What is the resulting velocity and indicate the direction of motion? (3 marks)

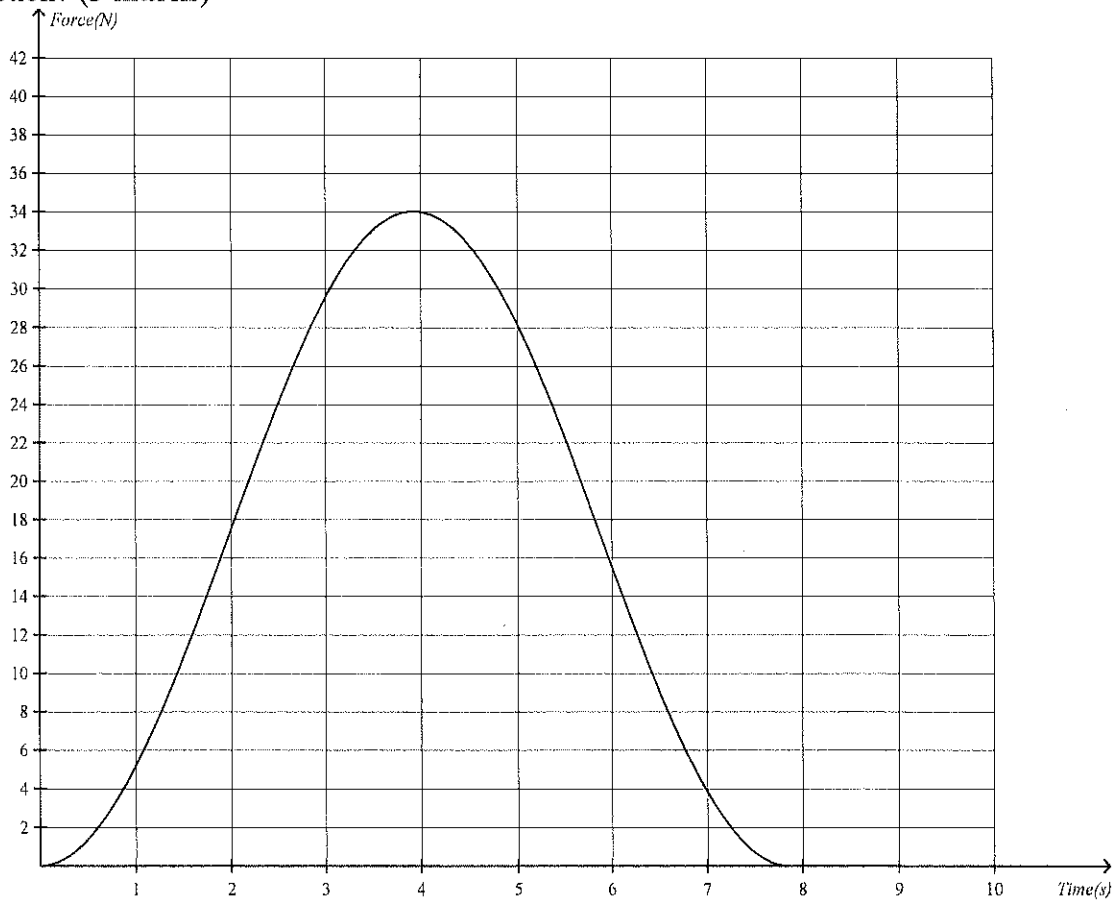


ANSWER:

Name: _____

ID: A

127. A 9 kg model vehicle travelling at 2 m/s [to the right] experiences a push [to the left] for a certain period of time as shown on the graph. What is the resulting velocity and indicate the direction of motion? (3 marks)



ANSWER:

128. A 62 kg astronaut is floating at a distance of 291 m from the International Space Station. If they throw their 7 kg tool in the opposite direction from the station at a velocity of 1 m/s, how long in seconds or minutes will it take the astronaut to reach the station? (3 marks)

ANSWER:

129. Outside the International Space Station, a 79 kg astronaut holding a 8 kg tool (both initially at rest) throws the tool at 2 m/s relative to the space station. A 113 kg astronaut, initially at rest, catches the tool. What is the speed of separation of the two astronauts? (3 marks)

ANSWER:

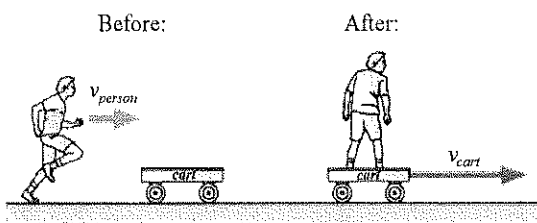
130. There are two canoes on the lake. One canoe has two people in it that weighs 1,000 N and the other canoe has three people and it weighs 1,945 N. One person pushed the other canoe with a force of 460 N for 0.6 s. What is the speed of separation of the two canoes? (3 marks)

ANSWER:

131. A 75 kg person is riding on 14 kg cart at a velocity of 20 m/s. With what velocity does the person need to jump forward in order to stop the cart? (3 marks)

ANSWER:

132. A 89 kg person runs along at a velocity of 8.5 m/s and jumps onto a 30 kg stationary cart. How fast does the person and cart move afterwards? (3 marks)

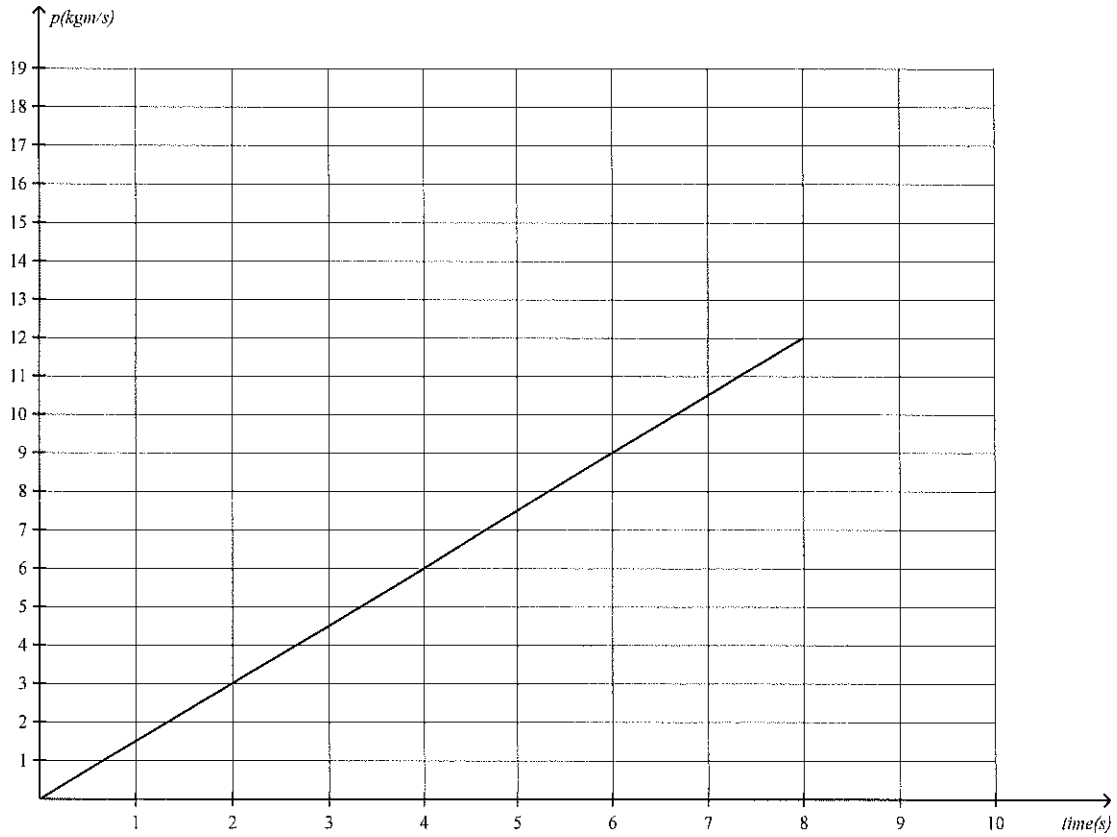


ANSWER:

133. Two boys of mass 63 kg and 71 kg, respectively, are sitting on 12 kg carts each, facing each other and holding a rope taut between them. The lighter boy pulls on the rope and acquires a velocity of 6 m/s. What is the velocity of the other boy? (3 marks)

ANSWER:

134. This graph depicts the motion of a box being pushed across the floor for 8s.



What is the force acting on the box? (2 marks)

ANSWER:

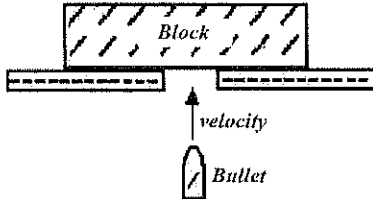
135. A rocket engine consumes 860 kg of fuel per minute. If the exhaust speed of the ejected fuel is 5.8 km/s, what is the thrust of the rocket? (3 marks)

ANSWER:

136. Two blocks with masses 3.2 kg and 9.4 kg are placed on a horizontal frictionless surface. A light spring is placed in a horizontal position between the blocks. The blocks are pushed together, compressing the spring, and then released from rest. After contact with the spring ends, the 9.4 kg mass has a speed of 8 m/s. How much potential energy was stored in the spring when the blocks were released? (3 marks)

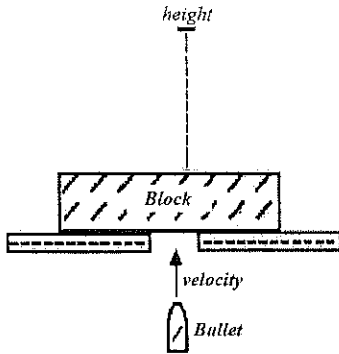
ANSWER:

137. A 0.20 kg bullet moving 540 m/s strikes and sticks in the 9.1 kg block initially at rest, as shown below. What maximum height will the block (with the bullet embedded) rise above its initial position? (3 marks)



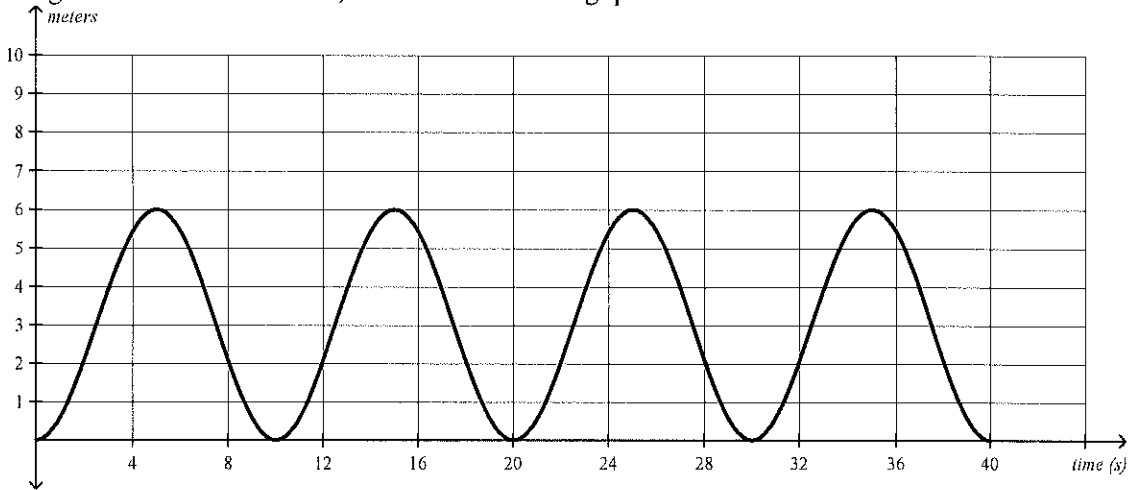
ANSWER:

138. A 0.40 kg bullet moving at a certain velocity strikes and sticks in the 2.6 kg block initially at rest, as shown below. If the block (with the bullet embedded) rises 23.2 m above its original position, what was the initial velocity of the bullet? (3 marks)



ANSWER:

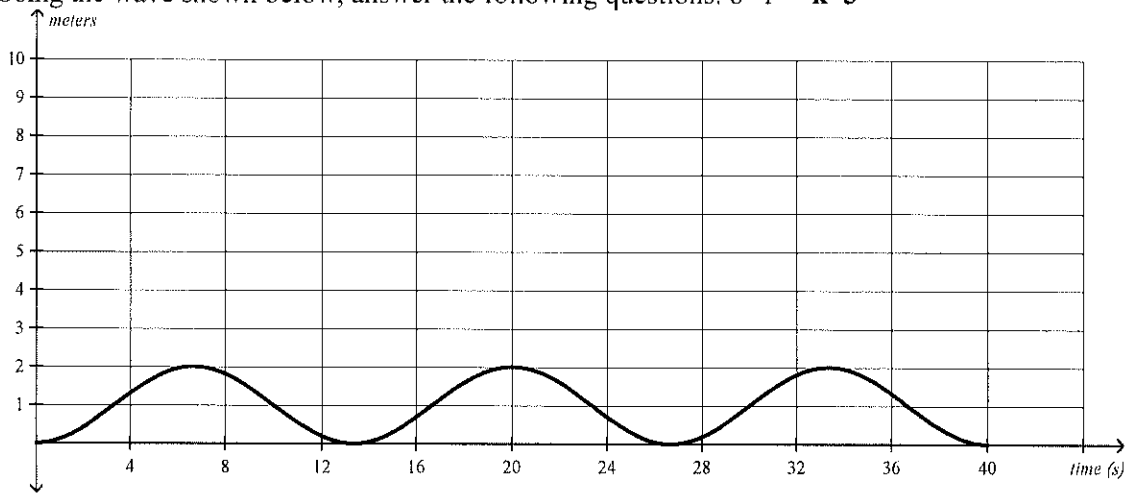
139. Using the wave shown below, answer the following questions. $b=3$ $k=4$



Name: _____

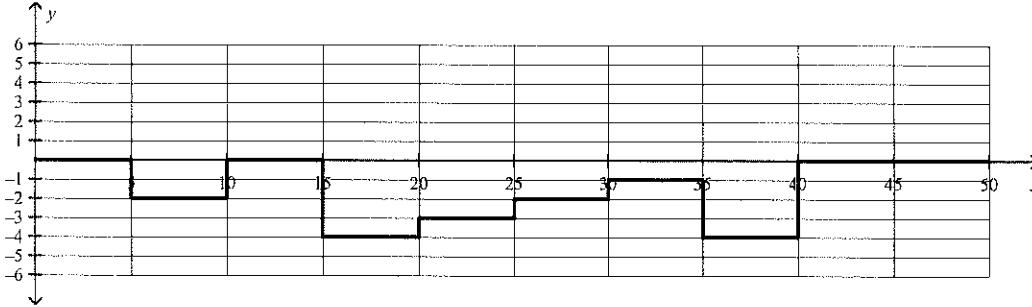
ID: A

140. Using the wave shown below, answer the following questions. $b=1$ $k=3$

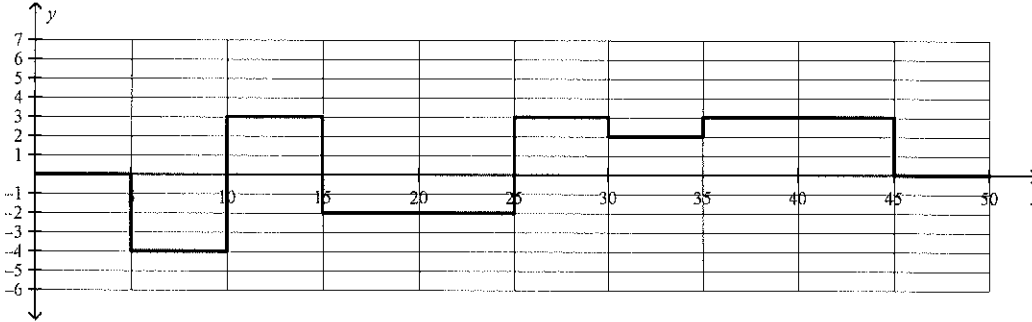


141. Sketch the result of superimposing the following two waves. (2 marks)

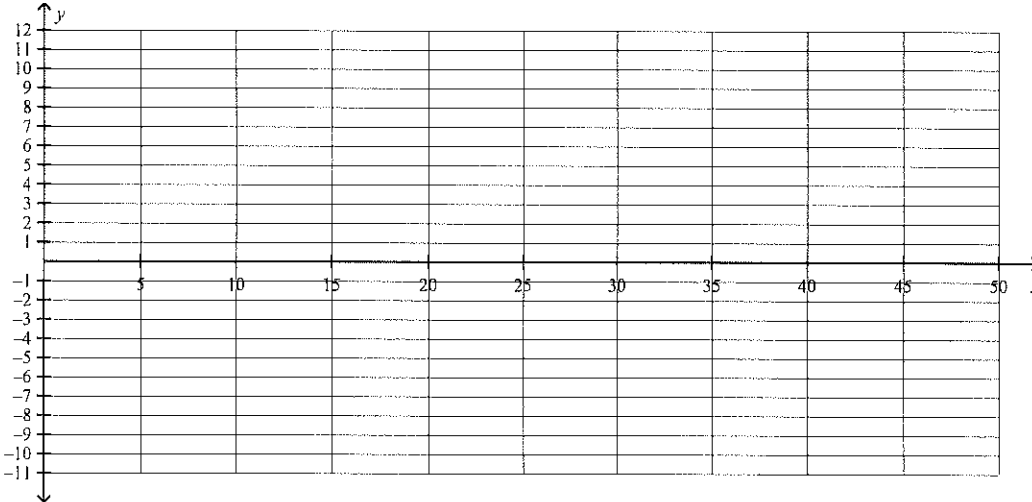
Wave A



Wave B

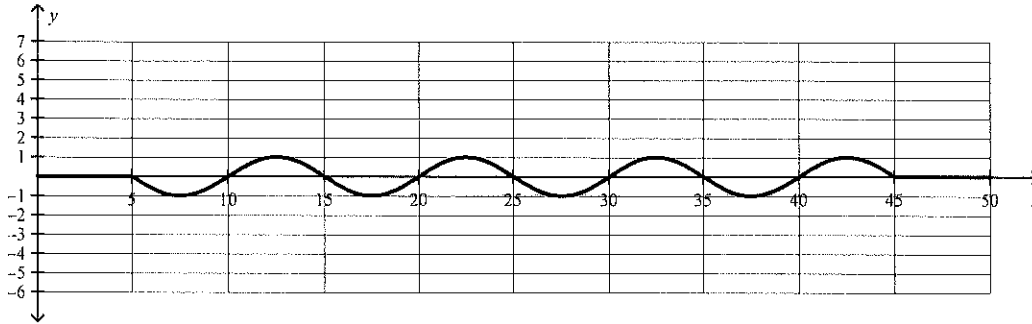


Wave A+B

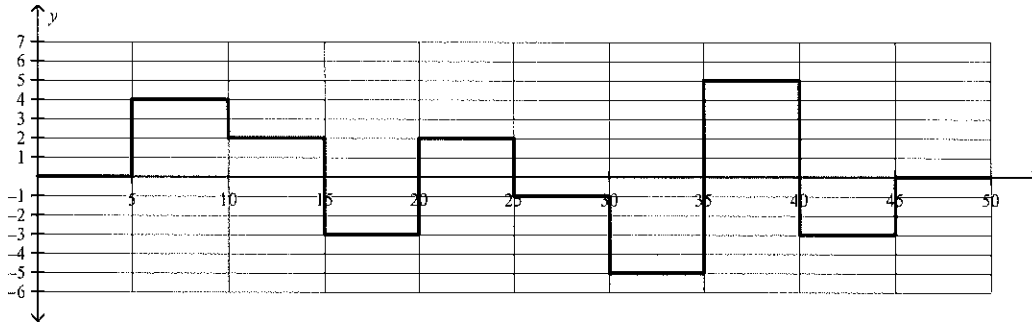


142. Sketch the result of superimposing the following two waves. (2 marks)

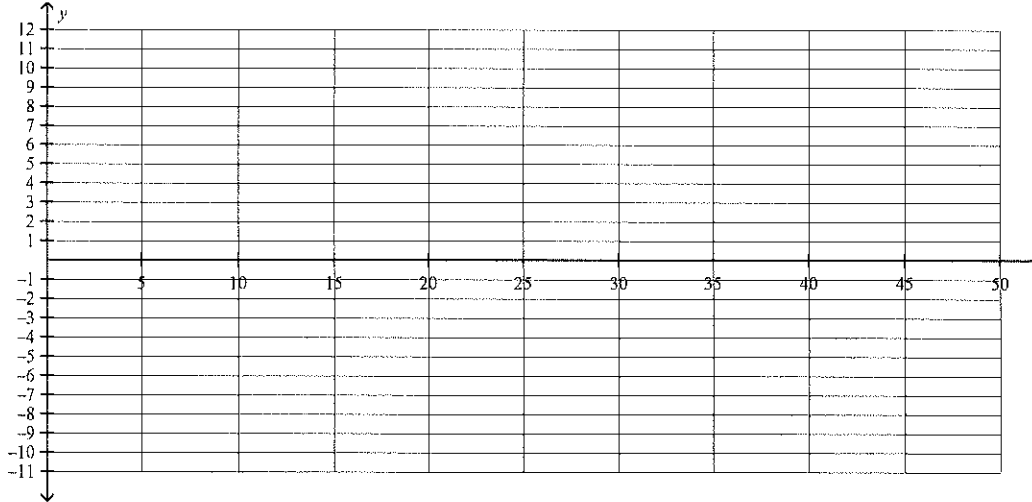
Wave A



Wave B

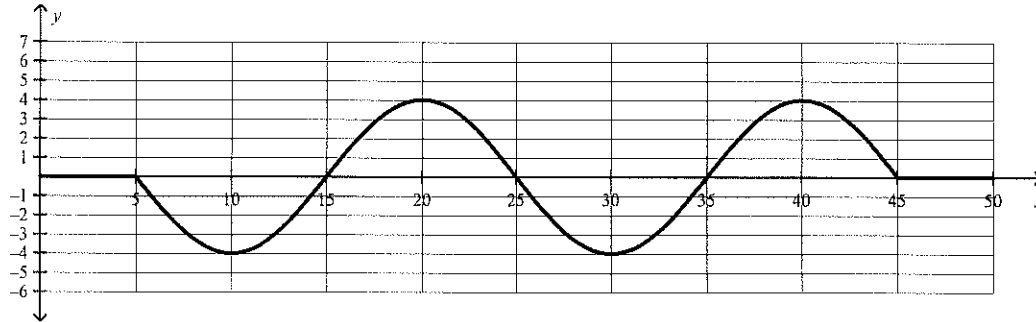


Wave A+B

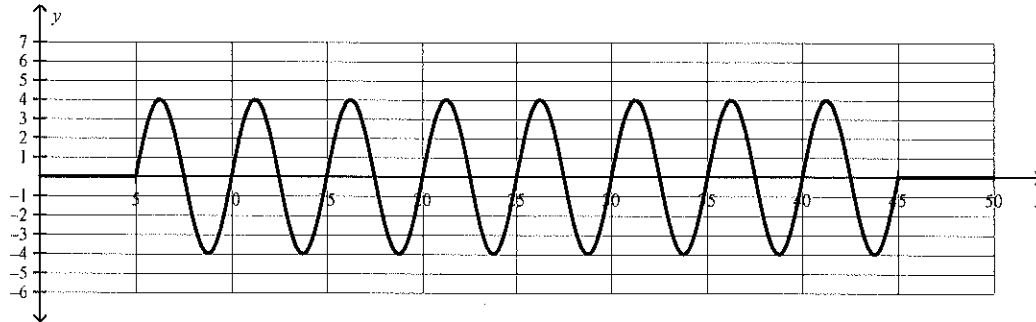


143. Sketch the result of superimposing the following two waves. (2 marks)

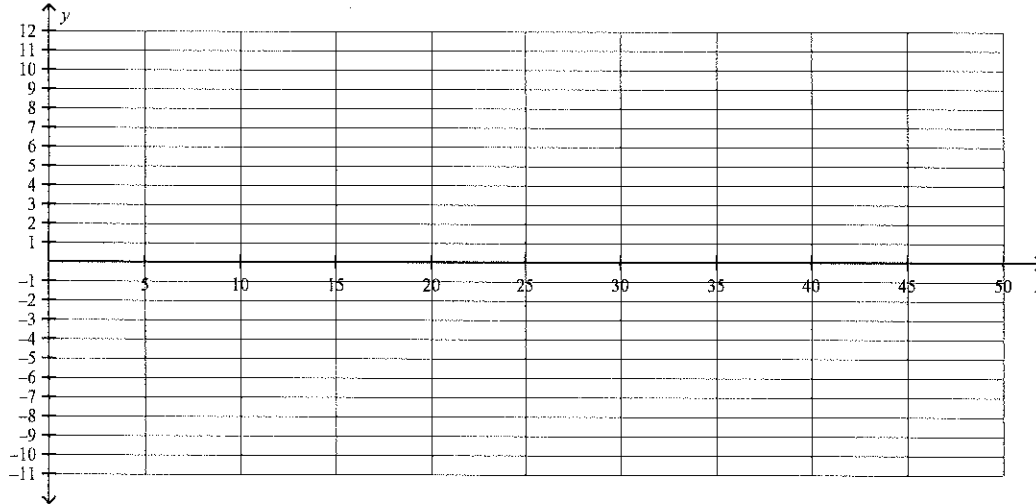
Wave A



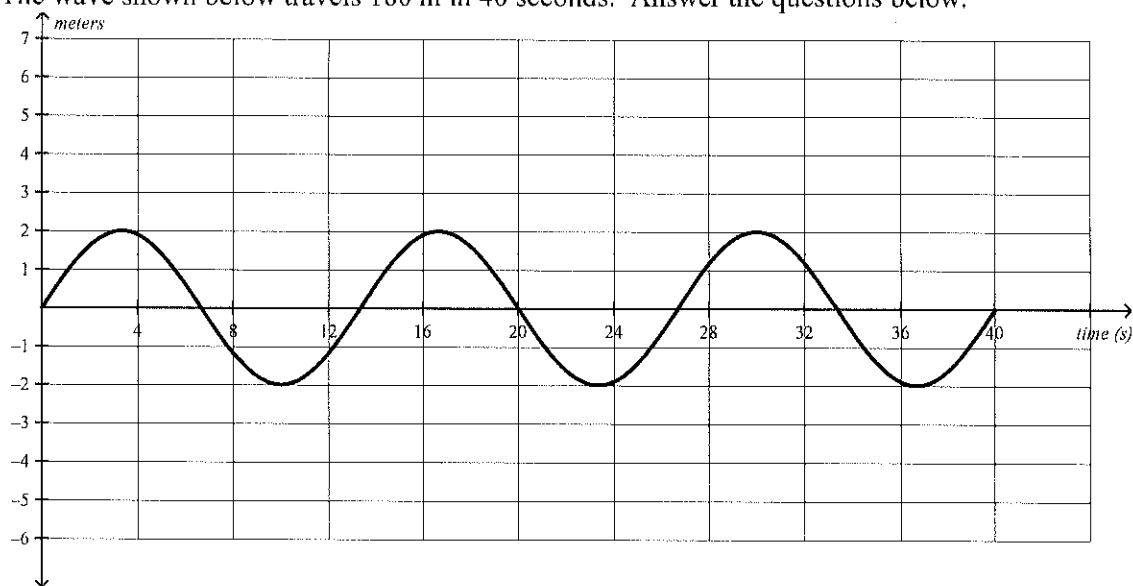
Wave B



Wave A+B



144. The wave shown below travels 180 m in 40 seconds. Answer the questions below.



a) What is the amplitude of the wave? (1 mark)

ANSWER:

b) What is the wavelength of the wave? (1 mark)

ANSWER:

c) What is the velocity of the wave? (1 mark)

ANSWER:

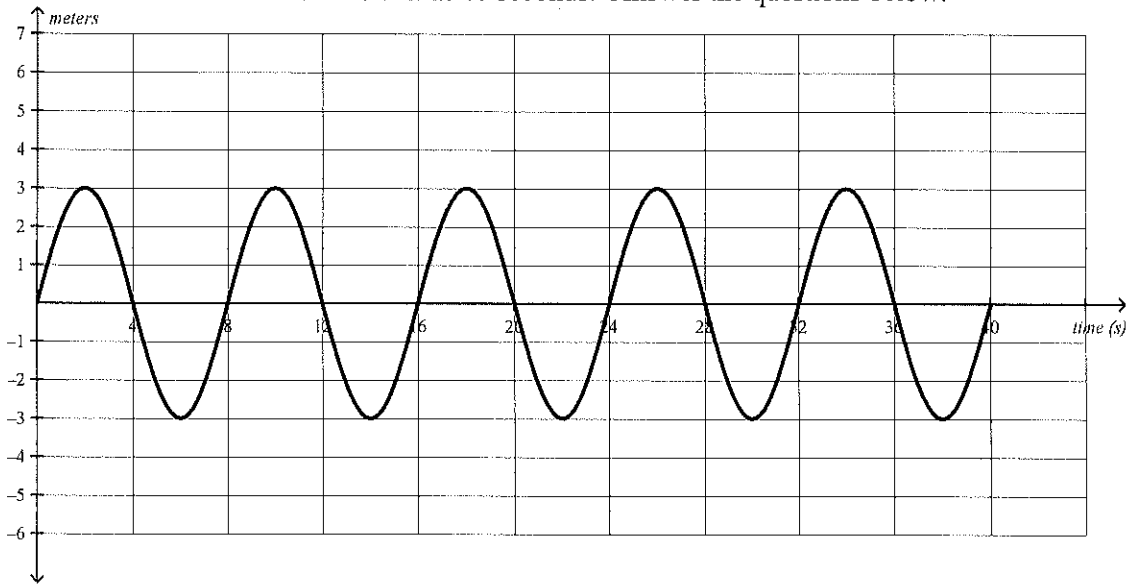
d) What is the frequency of the wave? (1 mark)

ANSWER:

e) What is the period of the wave? (1 mark)

ANSWER:

145. The wave shown below travels 90 m in 40 seconds. Answer the questions below.



a) What is the amplitude of the wave? (1 mark)

ANSWER: _____

b) What is the wavelength of the wave? (1 mark)

ANSWER: _____

c) What is the velocity of the wave? (1 mark)

ANSWER: _____

d) What is the frequency of the wave? (1 mark)

ANSWER: _____

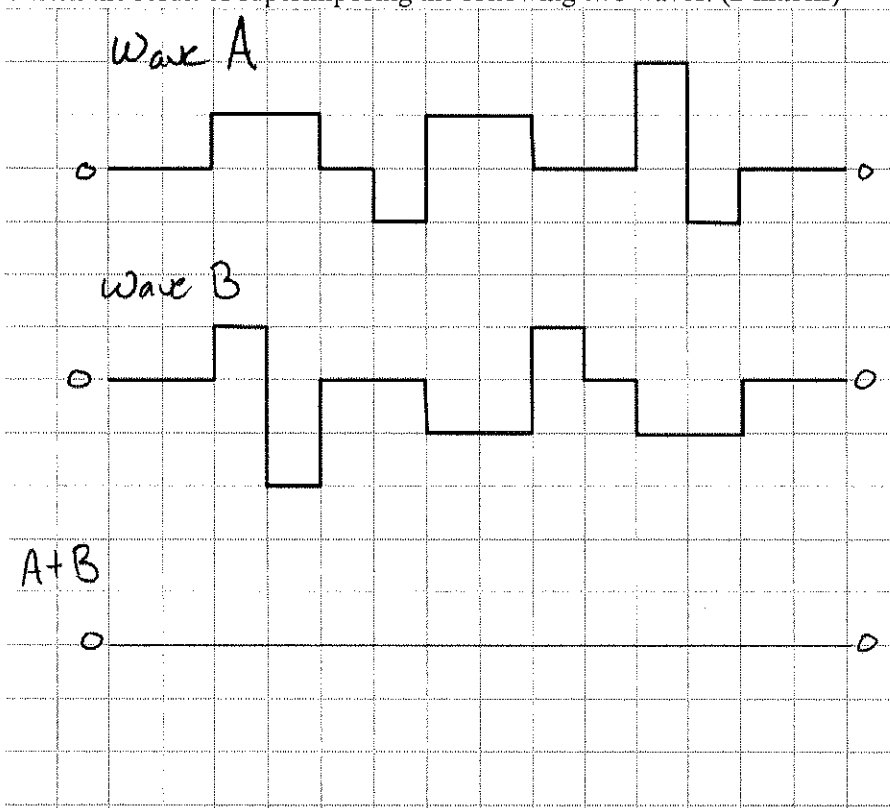
e) What is the period of the wave? (1 mark)

ANSWER: _____

f) How many nodes and antinodes are there? (1 mark)

ANSWER: _____

146. Sketch the result of superimposing the following two waves. (2 marks)



147. A standing wave in a clothesline has 8 nodes and 7 antinodes. The clothesline is 6 m long and is vibrating at 0.8 vibrations per second. What is the speed of the wave? (3 marks)

ANSWER:

148. The speed of an ocean wave on the coast is 38 m/s; the wavelength is 28 m. What is the frequency with which the wave hits the beach? (2 marks)

ANSWER:

Name: _____

ID: A

149. A sound wave with a frequency of 340 Hz has a wavelength of 0.7 m. What is the velocity of the sound wave? (2 marks)

ANSWER:

150. What is the speed of light in quartz ($n=1.54$)? (2 marks)

ANSWER:

151. If light is travelling at 42% the speed of light in a translucent material, what is the index of refraction of the material (2 marks)

ANSWER:

152. How far would a beam of light travel in a block of water ($n=1.33$) in 9.9×10^{-7} seconds? (3 marks)

ANSWER:

153. What is the index of refraction for a piece material that light can travel 5.5 m in 2.7×10^{-8} seconds?
(3 marks)

ANSWER:

154. A ray of light passes from quartz ($n=1.54$) into water ($n=1.33$) at an angle of incidence of 10° . Find the angle of refraction. (3 marks)

ANSWER:

155. A ray of light passes from water ($n=1.33$) into diamond ($n=2.42$) and refracts at an angle of 10° . Find the angle of incidence. (3 marks)

ANSWER:

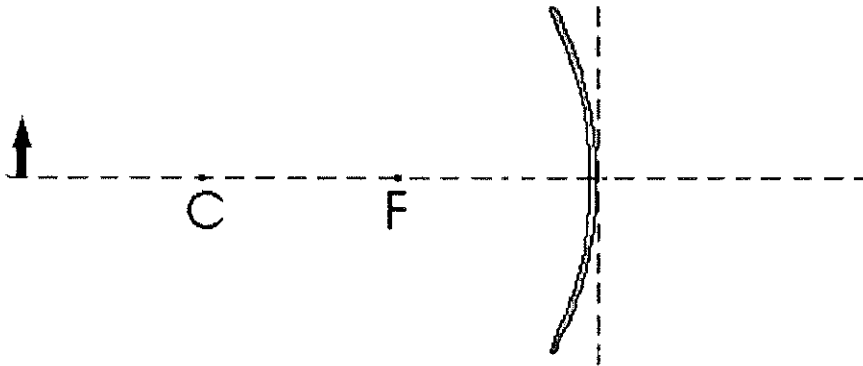
156. What is the critical angle of a light ray when passing from diamond ($n=2.42$) into flint glass ($n=1.61$) ? (3 marks)

ANSWER:

157. There is a concave mirror that has a center with a radius of 90 cm.
The 7 cm object is located 135 cm from the mirror.

Determine each of the following:

a) Draw the ray diagram carefully (use arrows on your lines to indicate direction of light ray). Draw your lines to the vertical dotted line behind the mirror before reflecting. Clearly draw the image produced. (1 mark)



b) Find the distance to the image. (2 marks)

ANSWER:

c) Find the image height (1 mark)

ANSWER:

d) Determine if the image is real or imaginary/virtual. (1/2 mark)

ANSWER:

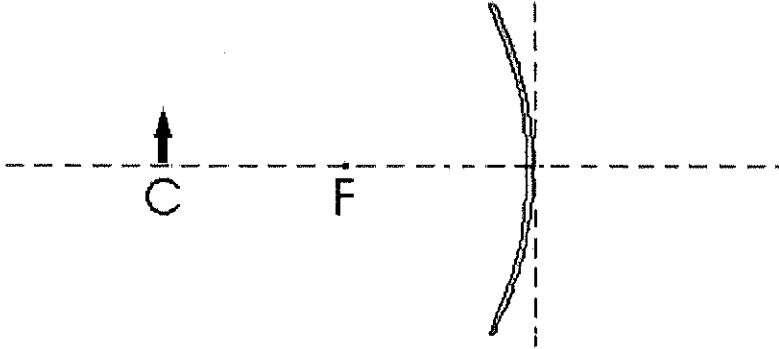
e) Find the magnification factor. (1/2 mark)

ANSWER:

158. There is a concave mirror that has a center with a radius of 66 cm.
The 10 cm object is located 66 cm from the mirror.

Determine each of the following:

- a) Draw the ray diagram carefully (use arrows on your lines to indicate direction of light ray). Draw your lines to the vertical dotted line behind the mirror before reflecting. Clearly draw the image produced. (1 mark)



- b) Find the distance to the image. (2 marks)

ANSWER:

- c) Find the image height (1 mark)

ANSWER:

- d) Determine if the image is real or imaginary/virtual. (1/2 mark)

ANSWER:

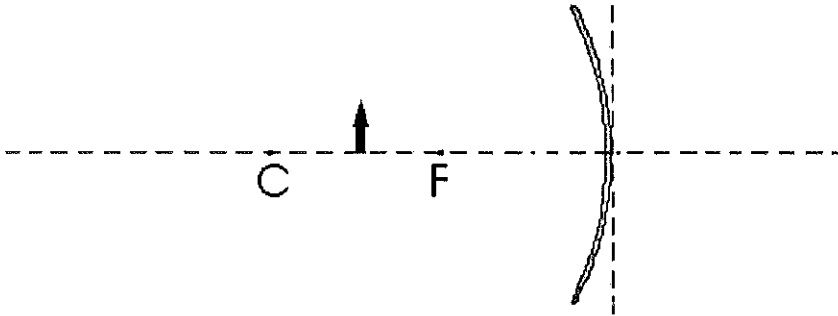
- e) Find the magnification factor. (1/2 mark)

ANSWER:

159. There is a concave mirror that has a center with a radius of 120 cm. The 16 cm object is located 69 cm from the mirror.

Determine each of the following:

a) Draw the ray diagram carefully (use arrows on your lines to indicate direction of light ray). Draw your lines to the vertical dotted line behind the mirror before reflecting. Clearly draw the image produced. (1 mark)



b) Find the distance to the image. (2 marks)

ANSWER: _____

c) Find the image height (1 mark)

ANSWER: _____

d) Determine if the image is real or imaginary/virtual. (1/2 mark)

ANSWER: _____

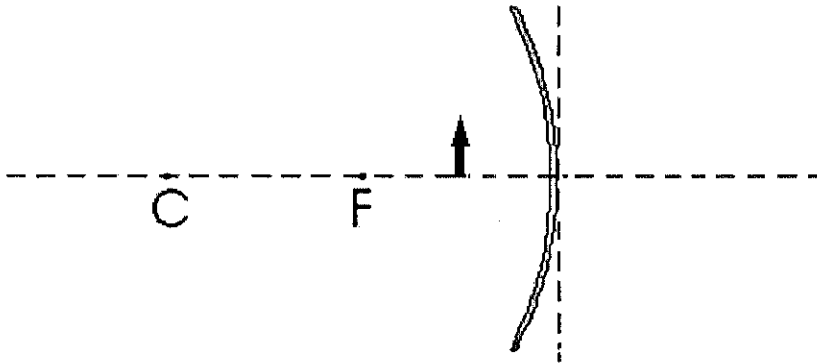
e) Find the magnification factor. (1/2 mark)

ANSWER: _____

160. There is a concave mirror that has a center with a radius of 102 cm.
The 9 cm object is located 30 cm from the mirror.

Determine each of the following:

- a) Draw the ray diagram carefully (use arrows on your lines to indicate direction of light ray). Draw your lines to the vertical dotted line behind the mirror before reflecting. Clearly draw the image produced. (1 mark)



- b) Find the distance to the image. (2 marks)

ANSWER:

- c) Find the image height (1 mark)

ANSWER:

- d) Determine if the image is real or imaginary/virtual. (1/2 mark)

ANSWER:

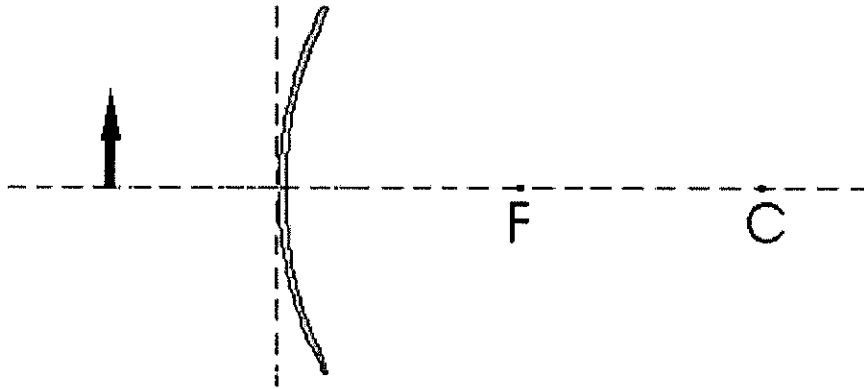
- e) Find the magnification factor. (1/2 mark)

ANSWER:

161. There is a convex mirror that has a center with a radius of 108 cm.
 The 14 cm object is located 53 cm from the mirror.

Determine each of the following:

a) Draw the ray diagram carefully (use arrows on your lines to indicate direction of light ray). Draw your lines to the vertical dotted line in front of the mirror. Clearly draw the image produced. (1 mark)



b) Find the distance to the image. (2 marks)

ANSWER:

c) Find the image height (1 mark)

ANSWER:

d) Determine if the image is real or imaginary/virtual. (1/2 mark)

ANSWER:

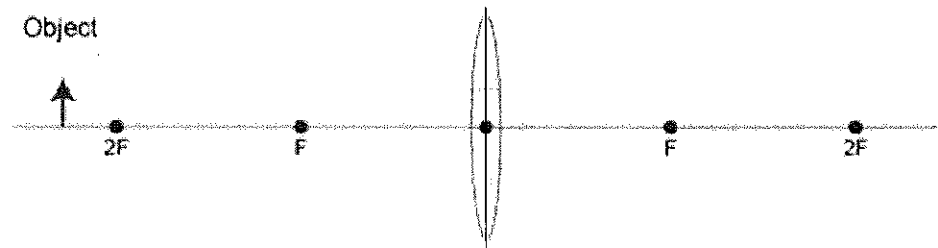
e) Find the magnification factor. (1/2 mark)

ANSWER:

162. There is a convex lens that has a focal point of 50 cm.
The 19 cm object is located 114 cm from the lens.

Determine each of the following:

a) Draw the ray diagram carefully (use arrows on your lines to indicate direction of light ray). Draw your lines to the middle of the lens before refracting. Clearly draw the image produced. **(1 mark)**



b) Find the distance to the image. **(2 marks)**

ANSWER: _____

c) Find the image height **(1 mark)**

ANSWER: _____

d) Determine if the image is real or imaginary/virtual. **(1/2 mark)**

ANSWER: _____

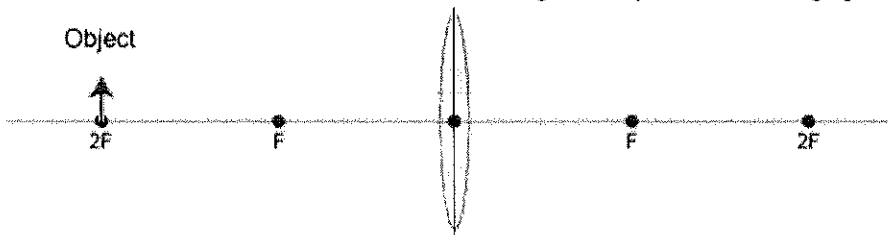
e) Find the magnification factor. **(1/2 mark)**

ANSWER: _____

163. There is a convex lens that has a focal point of 15 cm.
The 19 cm object is located 30 cm from the lens.

Determine each of the following:

a) Draw the ray diagram carefully (use arrows on your lines to indicate direction of light ray). Draw your lines to the middle of the lens before refracting. Clearly draw the image produced. **(1 mark)**



b) Find the distance to the image. **(2 marks)**

ANSWER:

c) Find the image height **(1 mark)**

ANSWER:

d) Determine if the image is real or imaginary/virtual. **(1/2 mark)**

ANSWER:

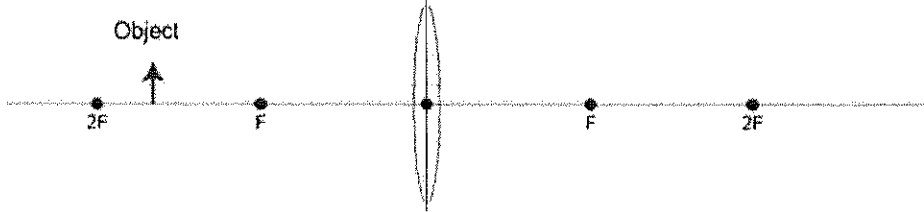
e) Find the magnification factor. **(1/2 mark)**

ANSWER:

164. There is a convex lens that has a focal point of 25 cm.
The 5 cm object is located 38 cm from the lens.

Determine each of the following:

a) Draw the ray diagram carefully (use arrows on your lines to indicate direction of light ray). Draw your lines to the middle of the lens before refracting. Clearly draw the image produced. **(1 mark)**



b) Find the distance to the image. **(2 marks)**

ANSWER:

c) Find the image height **(1 mark)**

ANSWER:

d) Determine if the image is real or imaginary/virtual. **(1/2 mark)**

ANSWER:

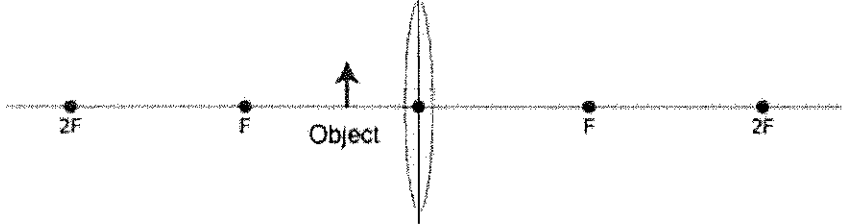
e) Find the magnification factor. **(1/2 mark)**

ANSWER:

165. There is a convex lens that has a focal point of 35 cm.
The 10 cm object is located 30 cm from the lens.

Determine each of the following:

- a) Draw the ray diagram carefully (use arrows on your lines to indicate direction of light ray). Draw your lines to the middle of the lens before refracting. Clearly draw the image produced. **(1 mark)**



- b) Find the distance to the image. **(2 marks)**

ANSWER:

- c) Find the image height **(1 mark)**

ANSWER:

- d) Determine if the image is real or imaginary/virtual. **(1/2 mark)**

ANSWER:

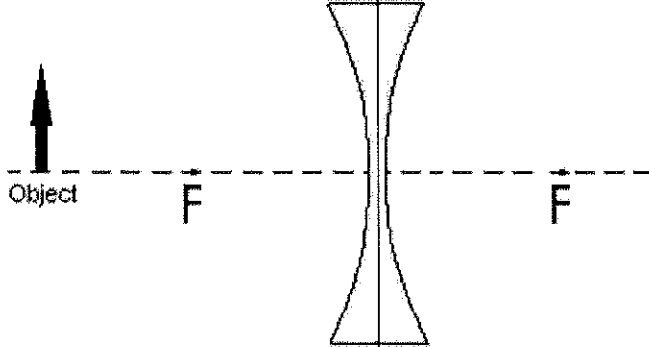
- e) Find the magnification factor. **(1/2 mark)**

ANSWER:

166. There is a concave lens that has a focal point of 26 cm.
The 8 cm object is located 35 cm from the lens.

Determine each of the following:

a) Draw the ray diagram carefully (use arrows on your lines to indicate direction of light ray). Draw your lines to the middle of the lens before refracting. Clearly draw the image produced. **(1 mark)**



b) Find the distance to the image. **(2 marks)**

ANSWER:

c) Find the image height **(1 mark)**

ANSWER:

d) Determine if the image is real or imaginary/virtual. **(1/2 mark)**

ANSWER:

e) Find the magnification factor. **(1/2 mark)**

ANSWER:

Name: _____

ID: A

167. A 17 cm object that is 11 cm from a convex mirror, has an upright image of 10.2 cm.
Determine the focal length of the mirror **(2 marks)**

ANSWER:

168. A 10 cm object is 14 cm from a concave mirror with a focal point of 3 cm.
Determine how far the image is from the mirror. **(2 marks)**

ANSWER:

169. A 13 cm object is 9 cm from a convex mirror with a focal point of 23 cm.
Determine how far the image is from the mirror. **(2 marks)**

ANSWER:

Name: _____

ID: A

170. A 10 cm object is 6 cm from a diverging lens with a focal point of 29 cm. Determine how far the image is from the lens. **(2 marks)**

ANSWER:

171. A 19 cm object is 14 cm from a converging lens with a focal point of 17 cm. Determine how far the image is from the lens. **(2 marks)**

ANSWER:

172. Using a GOOD diagram, draw a desert mirage. Label main parts and explain what is happening (in one or two sentences) **(1 mark)**

173. Using a GOOD diagram, draw an arctic mirage. Label main parts and explain what is happening (in one or two sentences) **(1 mark)**

.

174. Using a GOOD diagram, show why you can hear people across a lake better than if you were across a field. Label main parts and explain what is happening (in one or two sentences) **(1 mark)**

.

175. Using a GOOD diagram, show why it is harder to hear people in a desert than in a field . Label main parts and explain what is happening (in one or two sentences) **(1 mark)**

.

176. Using a GOOD diagram to show how light rays from a fish in the river looks to someone at the edge. Label main parts and explain what is happening (in one or two sentences) **(1 mark)**

.

Name: _____

ID: A

177. Explain how a light polarizer works using a GOOD diagram. Label main parts and explain what is happening (in one or two sentences) **(1 mark)**

.

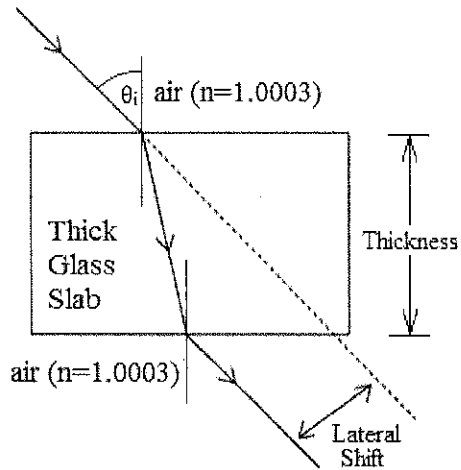
178. Explain how the doppler shift works using a GOOD diagram. Label main parts and explain what is happening (in one or two sentences) **(1 mark)**

.

179. Explain what spherical aberration is using a GOOD diagram. Label main parts and explain what is happening (in one or two sentences) **(1 mark)**

.

180. A light ray enters a 8 cm thick glass slab ($n=1.7$) at an angle of 60° to the normal. Then the light ray exits the thick glass slab into air . What is distance of the lateral shift? **(3 marks)**



ANSWER:

181. If an astronaut has aged 48 years going to a distant star then another 48 years coming home, then how much time has passed on Earth during the trip if he has been moving at $0.95 c$? **(3 marks)**

ANSWER:

Name: _____

ID: A

182. Your parents take you on a space voyage on your 6th birthday. When you get back from your trip, your best friend, who has the same birthday, is 16 years-old. If your ship was travelling at $0.9c$, how old are you (answer to 1 decimal)? **(3 marks)**

ANSWER:

183. The starship Millenium Falcon is moving through space at $0.95c$. If the Millenium Falcon is 14 m long to the people on the Millenium Falcon, how long would it appear to a stationary observer? **(3 marks)**

ANSWER:

184. The starship Soyuz is moving through space at $0.5c$. A person on Earth sees the ship fly by and notes that it is only 37 m long. How long is it when it is sitting in the space dock? **(3 marks)**

ANSWER:

185. a. How much energy would you get by changing 9 kg of gasoline into pure energy? (2 marks)

ANSWER:

b. How many times greater is this binding energy than the gasoline's chemical energy (39 Megajoule/kg)? (1 mark)

ANSWER:

186. What is the relativistic mass of a muon traveling at $0.9c$? (mass = 1.8×10^{-28} kg) (3 marks)

ANSWER:

187. Mr. Roome is lying down in a spaceship travelling at a rate of $0.99c$. According to the stationary Parkland students watching him travel past, he looks 0.7 m from head to toe. How tall is he actually? (3 marks)

ANSWER:

Name: _____

ID: A

188. If a clock on a spaceship travelling at $0.995c$ moves 2.6 hours according to a stationary, outside observer, much time has actually passed for someone standing inside the ship? **(3 marks)**

ANSWER:

189. If a stationary observer watches a spaceship travelling $0.9c$ at for 1.3 hours, how much time has passed for someone standing inside the spaceship? **(3 marks)**

ANSWER:

190. An astronaut leaves Earth at $0.98c$. From inside the spaceship, the astronaut sees a solar system that is 6.1 light years away (1 light year is how far light travels in one year, which is quite far you know). How long will it take them to make a return trip, according to Earthlings? (in years)? **(3 marks)**

ANSWER:

Name: _____

ID: A

191. A student moving in a spaceship at $0.4c$, is writing a Physics 11 Special Relativity test. He uses the full 80 minutes to complete the test. A Parkland student is writing the same test on Earth and sees the other student travel past. The Parkland student complains to the teacher that the moving student received more time for the exam. How long (in minutes) does the Parkland student think the moving student was given to write the test? (3 marks)

ANSWER:

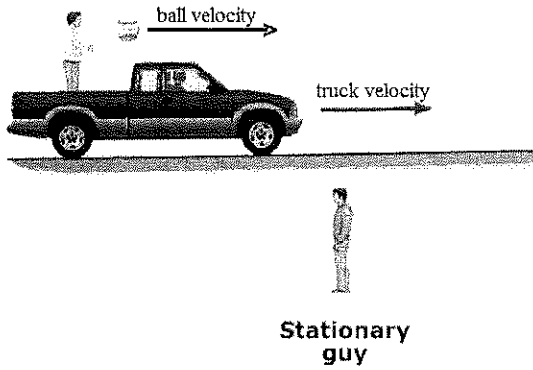
192. An astronaut who is 62 kg is travelling on a spaceship at a velocity of $0.5c$ is on a diet. After several months he has lost 13 kg. According to a stationary observer, how heavy is the (still moving) astronaut after the diet? (3 marks)

ANSWER:

Name: _____

ID: A

193. A stationary man observes a truck moving past him at $0.8c$. Another man is standing in the back of the truck and throws a baseball forward at $0.9c$. How fast is the baseball moving with respect to the stationary man (answer to 4 decimal places)? (3 marks)



ANSWER:

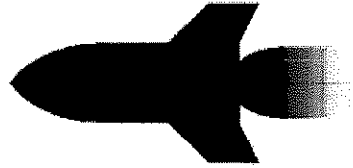
Name: _____

ID: A

194. The spaceship Enterprise is moving at a velocity of $0.3c$ according to people on Earth. The spaceship Apollo is moving towards spaceship Enterprise at a velocity of $0.5c$ according to people on Earth. How fast does the captain of Enterprise see the spaceship Apollo approaching them (answer to 4 decimal places)? (3 marks)



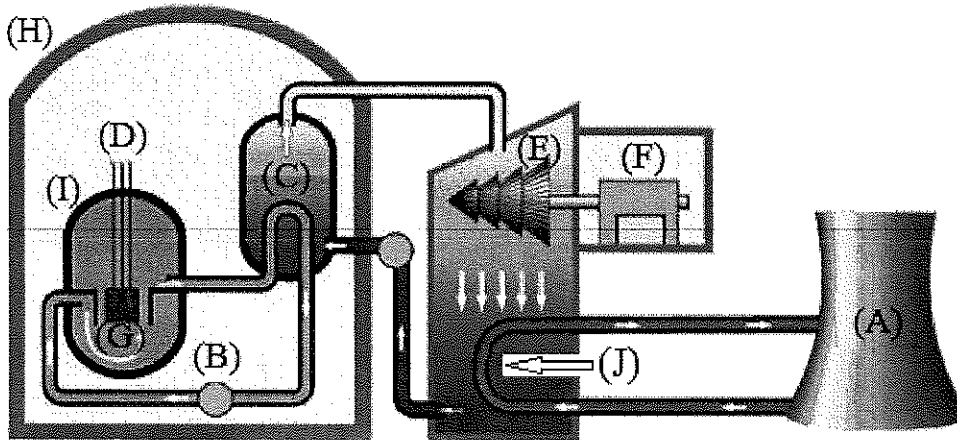
Spaceship 'Left'



Spaceship 'Right'

ANSWER:

195. Identify the part of the nuclear reactor complex. (5 marks, 1/2 mark for each term)



Write the letters from the picture above beside the matching terms:

	condensator cooling water		reactor core
	pump		generator
	reactor vessel		cooling tower
	turbine		containment structure
	control rods		steam generator

196. What is the daughter product if the radioactive isotope Astatine-216 under goes alpha decay? (2 marks)

ANSWER:

197. If the element Uranium-238 is produced after alpha decay, what was the parent isotope? (2 marks)

ANSWER:

Name: _____

ID: A

198. What is the daughter product if the radioactive isotope Beryllium-9 under goes beta decay? (2 marks)

ANSWER:

199. If the element Potassium-38 is produced after beta decay, what was the parent isotope? (2 marks)

ANSWER:

200. List 2 advantages of a CANDU reactor over an american style reactor. (2 marks)

201. Describe how a control rod works. (1 mark)

202. What is a chain reaction when dealing with nuclear fission? (1 mark)

203. TRUE or FALSE: (1 mark)

T / F Canadian reactors need the uranium to be enriched to 3% in order to work

204. What is the difference between nuclear fission and nuclear fusion. (2 marks)

205. TRUE or FALSE: (1 mark)

T / F Fissionable atomic bombs require 90% U-238 in order to work.