Name: _____

Teacher: _____

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

PHYSICS 2204

FINAL EXAMINATION

June 2009

Value: 100%

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.

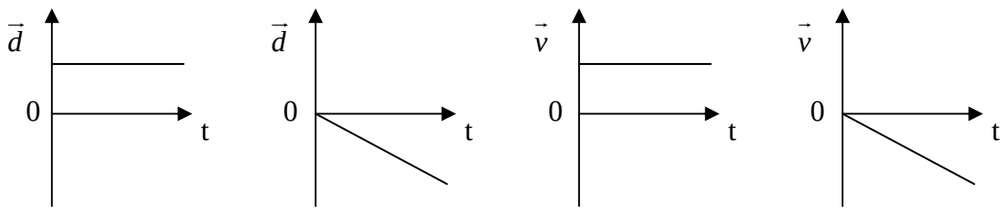
ALL MATERIALS MUST BE PASSED IN WITH THIS EXAM. Use your time wisely. Good luck!

Part I
Total Value: 40%

1. Which is true of acceleration and speed?

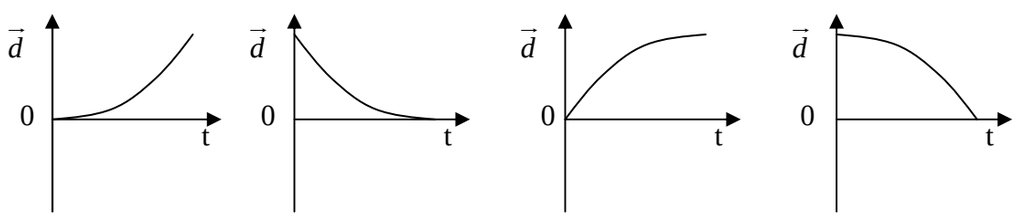
	Displacement	Speed
(A)	scalar	scalar
(B)	scalar	vector
(C)	vector	scalar
(D)	vector	vector

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



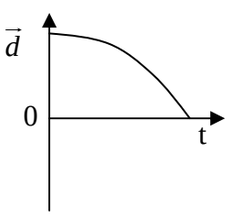
(A) (B) (C) (D)

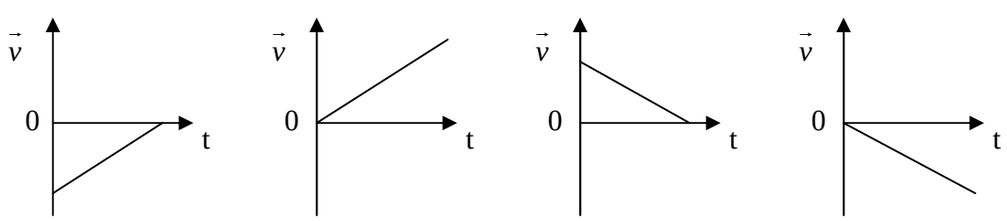
3. Which graph represents an object moving to the right and speeding up?



(A) (B) (C) (D)

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





(A) (B) (C) (D)

5. An object initially moving at 2.5 m/s accelerates at 1.5 m/s^2 for 3.2 s. What is its final speed?

(A) 2.3 m/s
(B) 4.8 m/s
(C) 7.3 m/s
(D) 9.5 m/s

6. 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

7. An object is thrown vertically upwards with an initial velocity of 6.8 m/s. How far does it travel in 0.60 s?

(A) 1.1 m
(B) 2.3 m
(C) 4.1 m
(D) 5.8 m

8. 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

9. A moving sidewalk has a velocity of 1.5 m/s [E] relative to the ground. A child is running on the sidewalk at 4.5 m/s [W]. What is the velocity of the child relative to the ground?

(A) 3.0 m/s [E]
(B) 3.0 m/s [W]
(C) 6.0 m/s [E]
(D) 6.0 m/s [W]

10. What is the weight of a 56.0 kg person?

(A) 5.71 N
(B) 56.0 N
(C) 123 N
(D) 549 N

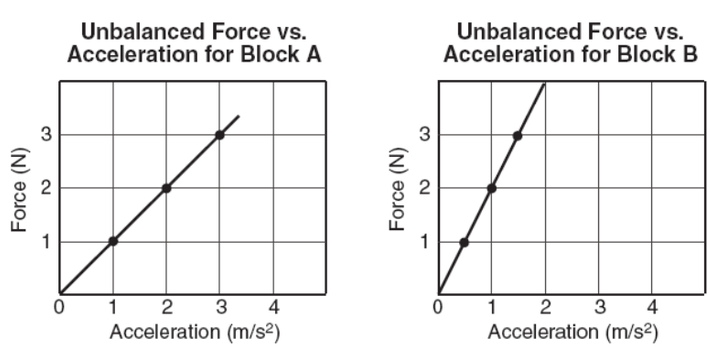
11. Which best explains why people should wear seatbelts?

(A) Newton's First Law
(B) Newton's Second Law
(C) Newton's Third Law
(D) Newton's Law of Universal Gravitation

12. What is the magnitude of the net force acting on a 2.50 kg mass that is accelerating at 4.20 m/s^2?

(A) 0.595 N
(B) 1.68 N
(C) 8.40 N
(D) 10.5 N

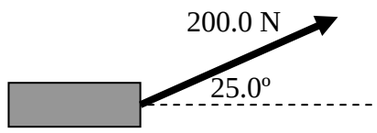
13. The graphs below show the relationship between force and acceleration for two blocks, A and B. How does the mass of each block compare?



(A) $m_A = m_B$
(B) $\frac{1}{2} m_A = m_B$
(C) $2m_A = m_B$
(D) $4m_A = m_B$

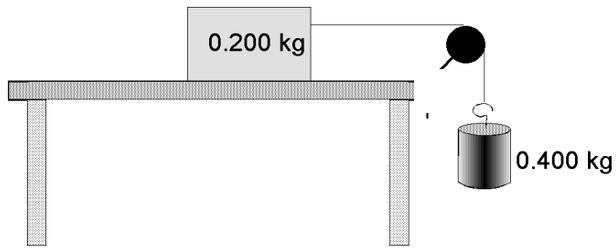
14. A force of 200.0 N is applied to an object at an angle of 25.0° above the horizontal. What is the magnitude of the horizontal component of this force?

(A) 0.423 N
(B) 0.906 N
(C) 84.5 N
(D) 181 N



15. A 0.400 kg mass is attached to a 0.200 kg block as shown. Assuming no friction, what is the magnitude of the acceleration of the 0.200 kg mass?

(A) 3.92 m/s^2
(B) 6.53 m/s^2
(C) 9.80 m/s^2
(D) 19.6 m/s^2



16. Which force slows a puck gliding along rough ice?

(A) kinetic friction
(B) normal force
(C) static friction
(D) weight

17. What is the force of static friction between a 100.0 kg box and a table if the coefficient of static friction is 0.010?

(A) 0.098 N
(B) 9.8 N
(C) 98 N
(D) 980 N

18. A 10.0 kg box on a horizontal surface is pulled to the right by a 5.0 N force. What is the magnitude of the acceleration of the box if the frictional force is 3.0 N?

(A) 0.20 m/s^2
(B) 0.80 m/s^2
(C) 1.3 m/s^2
(D) 2.0 m/s^2

19. What is the separation distance between two 180 kg objects that experience a gravitational force of 2.00×10^{-4} N?

(A) 0.011 m
(B) 0.10 m
(C) 9.6 m
(D) 93 m

20. A driver accelerates a 240.0 kg snowmobile from 6.0 m/s to 28.0 m/s. What is the impulse on the snowmobile?

(A) 1440 kg·m/s
(B) 5280 kg·m/s
(C) 6720 kg·m/s
(D) 8160 kg·m/s

21. Which is the rate at which work is done?

(A) efficiency
(B) force
(C) power
(D) work

22. A horizontal force of 3.0 N is applied to an object on a frictionless surface and 33 J of work is done. What distance does the object move?

(A) 0.091 m
(B) 11 m
(C) 36 m
(D) 99 m

23. A wagon is pulled 5.00 m along a sidewalk by a force of 55.0 N exerted at an angle of 35.0° to the horizontal. How much work is done on the wagon?

(A) 45.1 J
(B) 90.1 J
(C) 158 J
(D) 225 J

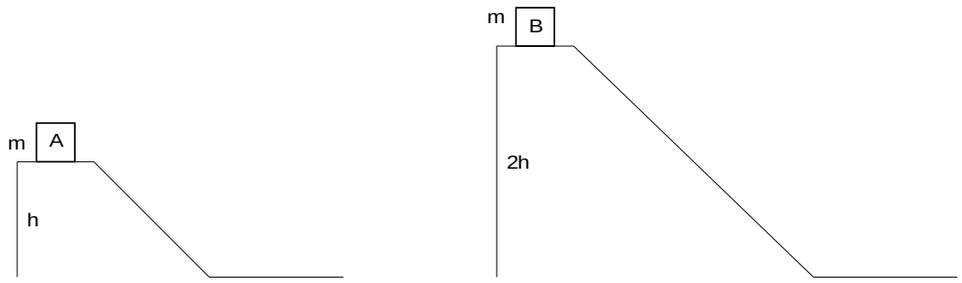
24. A student normally takes 40 s to climb a flight of stairs. Which is true if she climbs the same stairs in 20 s?

(A) She develops half her normal power.
(B) She develops twice her normal power.
(C) She does half as much work.
(D) She does twice as much work.

25. What is the kinetic energy of a 4.00 kg bicycle that is moving at 8.50 m/s?

(A) 17.0 J
(B) 68.0 J
(C) 145 J
(D) 289 J

26. The picture below shows two identical blocks A and B, each with mass *m*, resting at the top of two hills. How does the gravitational potential energy of each block compare?



(A) $\left(E_g\right)_A = \frac{1}{2}\left(E_g\right)_B$
(B) $\left(E_g\right)_A = \left(E_g\right)_B$
(C) $\left(E_g\right)_A = \sqrt{2}\left(E_g\right)_B$
(D) $\left(E_g\right)_A = 2\left(E_g\right)_B$

27. In which situation is potential energy converted to kinetic energy?

(A) A ball rolling on a flat surface is slowed by friction.
(B) A ball rolls slower and slower as it rolls uphill.
(C) A horizontal spring is compressed by a force.
(D) A rock in a sling shot is launched horizontally.

28. A horizontal spring with a spring constant of 140 N/m is extended 0.20 m from the equilibrium position. How much elastic potential energy is stored in the spring?

(A) 2.8 J
(B) 5.6 J
(C) 11 J
(D) 14 J

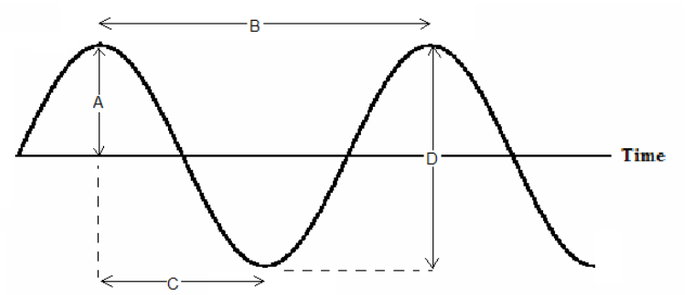
29. A force of 1100 N is applied over a distance of 10.0 m on a ramp. What is the efficiency of the ramp if 5100 J of work is done?

(A) 0.46 %
(B) 2.2 %
(C) 46 %
(D) 216 %

30. Which is the time required for a wave to complete one full cycle?

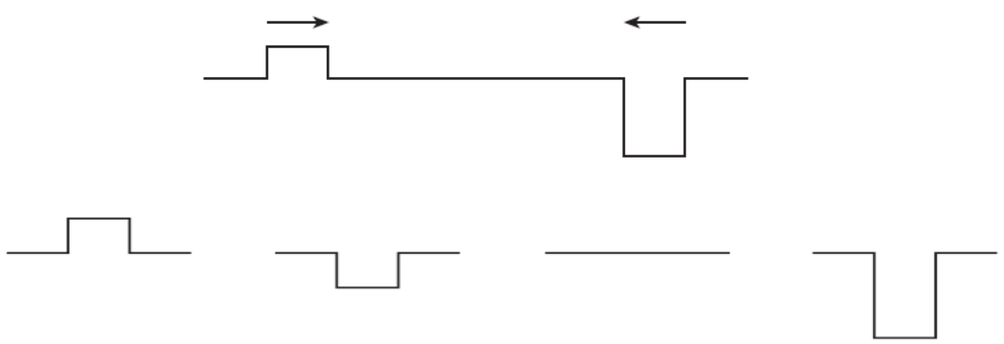
(A) amplitude
(B) frequency
(C) period
(D) wavelength

31. Which represents wavelength in the diagram shown?



(A) A
(B) B
(C) C
(D) D

32. The diagram shown represents two wave pulses approaching one another. Which represents the resultant pulse at the instant the individual pulses are passing through each other?

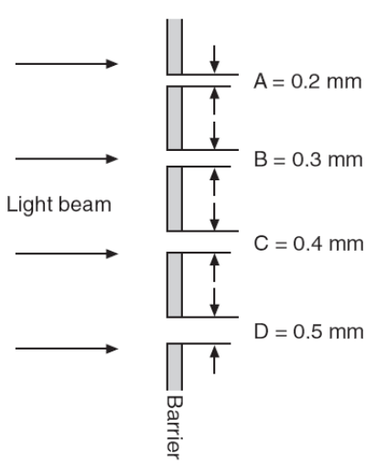


(A) (B) (C) (D)

33. Which explains the formation of an image in a plane mirror?

(A) diffraction
(B) rarefraction
(C) reflection
(D) refraction

34. A beam of light approaches a barrier having four openings A, B, C and D of different sizes as shown. Which opening will cause the greatest amount of diffraction?



(A) A
(B) B
(C) C
(D) D

35. How much time does it take light from a flash camera to reach a subject 6.0 m across a room?

(A) 5.6×10^{-10} s
(B) 2.0×10^{-8} s
(C) 5.0×10^{7} s
(D) 1.8×10^{9} s

36. In which medium does sound travel fastest?

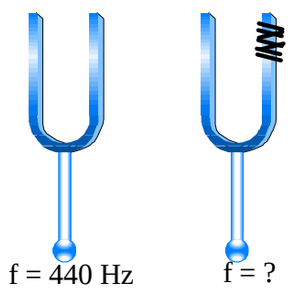
(A) air
(B) steel
(C) vacuum
(D) water

37. A police car travelling at 30.0 m/s sounds its 525 Hz siren as it approaches a person standing on the side of the road. If the speed of sound is 344 m/s, what frequency is heard by the person?

(A) 483 Hz
(B) 525 Hz
(C) 555 Hz
(D) 575 Hz

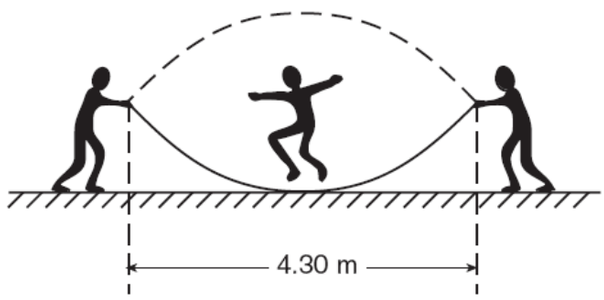
38. Two tuning forks, each stamped "440Hz", are sounded at the same time. One of the tuning forks has an elastic band wrapped around one of its tines as shown. If a beat frequency of 5 Hz is detected, what is the frequency of the second fork?

(A) 5 Hz
(B) 88 Hz
(C) 435 Hz
(D) 445 Hz



39. While playing, two children create a standing wave on a rope as shown below. What is the wavelength of the standing wave?

(A) 2.15 m
(B) 4.30 m
(C) 6.45 m
(D) 8.60 m



40. Wave X travels eastward with frequency f, and speed, v. Wave Y, travelling in the same medium, interacts with wave X and produces a standing wave. If speed is constant, which is correct for wave Y?

	Direction	Frequency
(A)	eastward	f
(B)	eastward	2f
(C)	westward	f
(D)	westward	2f

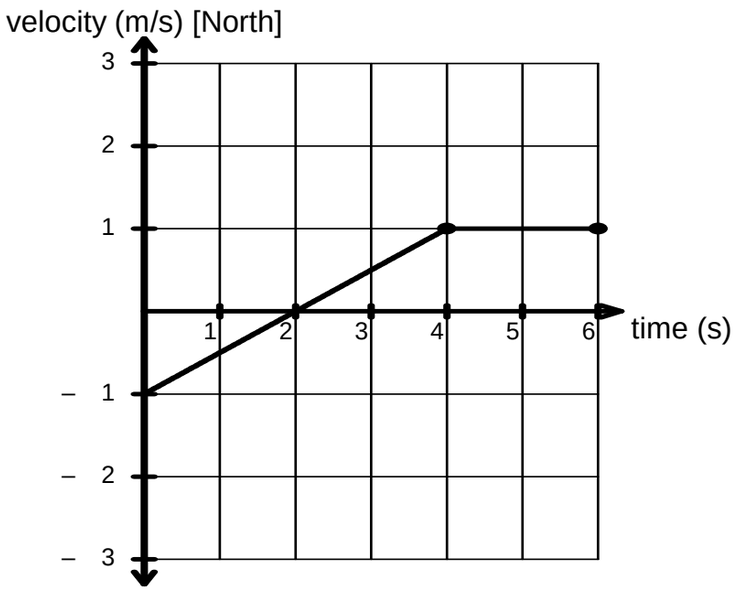
End of Part I

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

41. a) The motion of an object is graphed below.



2 i) Calculate the magnitude of the acceleration of the object at $t = 2\,s$.

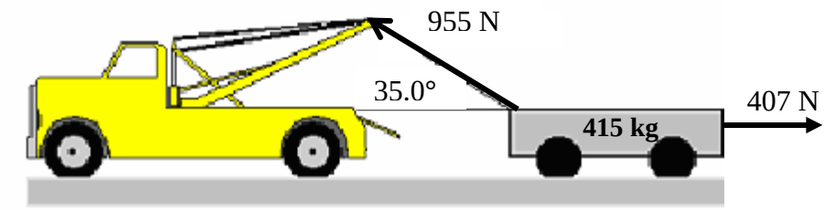
2 ii) Calculate the average velocity of the object between $t = 2\,s$ and $t = 4\,s$.

2 iii) Calculate the distance traveled by the object between $t = 2\,s$ and $t = 6\,s$.

4 41. b) The driver of a car travelling at 25 m/s suddenly sees the lights of a barrier 45 m ahead. It takes the driver 0.75 s to apply the brakes and the acceleration during braking is – 9.5 m/s^2. Calculate whether the car will hit the barrier.

4 c) An aircraft can fly at 355 km/h with respect to the air. The wind is blowing towards the west at 95.0 km/h with respect to the ground. The pilot wants to land at an airport that is directly north of his present location. Calculate the direction in which the plane should head and its speed with respect to the ground. Include a vector diagram in your answer.

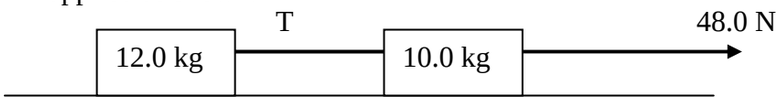
42. a) A tow truck is applying a 955 N force at 35.0° above the horizontal to a 415 kg cart as shown. The frictional force between the cart and the road is 407 N.



1 i) Draw a free body diagram for the cart.

3 ii) Calculate the magnitude of the acceleration of the cart.

b) Two boxes on a frictionless table are connected by a rope. A force of 48.0 N is applied as shown.



2 i) Calculate the magnitude of the acceleration of the blocks.

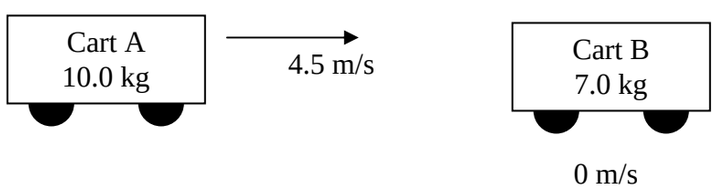
2 ii) Calculate the magnitude of the tension, T, in the connecting rope.

42. c) A bag containing 20.0 kg of groceries is lifted vertically upwards from the floor to a table. The maximum force the bag can withstand without ripping is 250 N.

1.5 i) Calculate whether the bag will rip if it is lifted at a constant speed.

2.5 ii) Calculate whether the bag will rip if is lifted with an acceleration of 5.1 m/s^2.

4 d) Cart B of mass 7.0 kg is initially at rest. Cart A of mass 10.0 kg approaches cart B with a velocity of 4.5 m/s (E) as shown. The carts do not stick together on collision. If cart A moves at 2.3 m/s (E) after the collision, calculate the velocity of cart B after the collision.

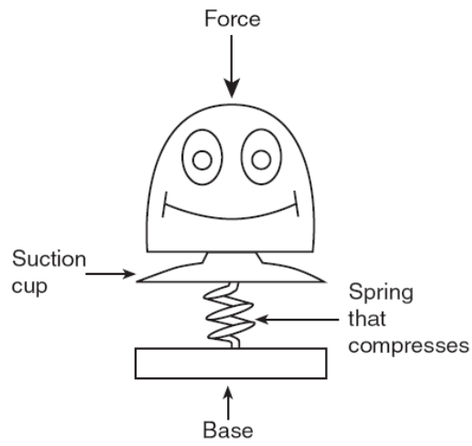


3 43. a) Calculate the amount of work done when an 1150 kg car accelerates from 2.00 m/s to 6.00 m/s.

3 b) A crane with a power output of 3500 W is used to lift a mass of 250 kg. Calculate the time required to lift the mass from the second to the fifth floor if each floor is 4.5 m high.

4 c) A 2.00 kg ball is launched vertically upward from the ground with a speed of 55.2 m/s. Calculate the speed of the ball 50.0 m above the ground. Assume that mechanical energy is conserved.

4 43. d) A pop-up toy has a mass of 0.020 kg and a spring constant of 150 N/m as shown. A force is applied to the toy to compress the spring 0.050 m. Calculate whether the toy will hit a 2.1 m high ceiling when it is released.



2 44. a) When timing a 100 m race, officials at the finish line are instructed to start their stopwatches at the sight of smoke from the starter's pistol and not at the sound of its firing. Explain why this is necessary.

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_____

_____

_____

_____

4 b) An open vertical tube is filled with water. A tuning fork vibrates over its mouth. As the water level is lowered in the tube, resonance is first heard when the water level is 0.17 m from the top of the tube and the next when the water is 0.51 m from the top of the tube. If the air temperature is 22.7° C, calculate the frequency of the tuning fork.

44. c) A standing wave pattern containing four antinodes is produced on a 1.2 m long rope.

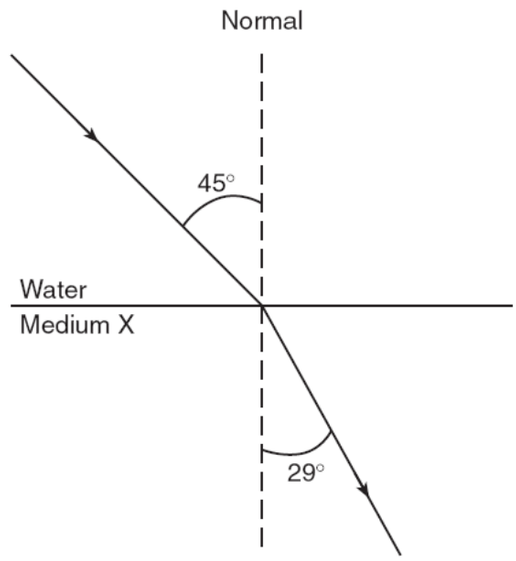
1 i) Sketch the standing wave pattern produced.

1 ii) Determine the wavelength.

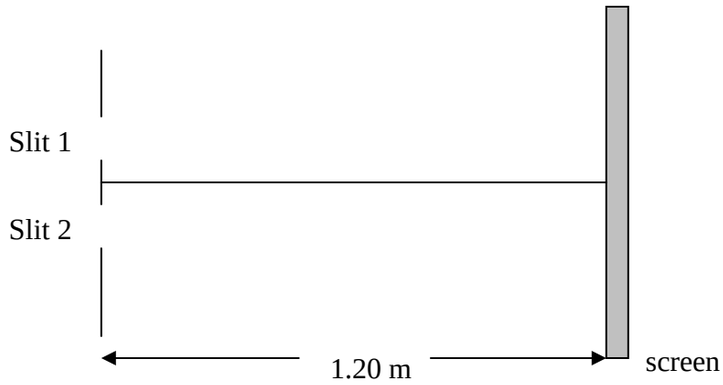
2 iii) Calculate the frequency of the source if the speed of the wave is 15 m/s.

3 d) A ray of light initially travelling in water ($n = 1.33$), is incident on medium X. The angle of incidence in water is 45.0° and the angle of refraction in medium X is 29.0° as shown. Use calculations to determine the index of refraction for medium X and use the chart shown to identify medium X.

Material	Index of Refraction
diamond	2.42
glass	1.50
glycerine	1.47
zircon	1.94



3 44. e) Light of wavelength 5.42×10^{-7} m shines on two slits that are 1.6×10^{-6} m apart. An interference pattern is produced on a screen that is 1.20 m from the slits as shown.



i) Calculate the angle at which the second order maximum occurs.

ii) Calculate the distance of the second order maximum from the central bright line on the screen.

End of Part II