2004

Year 11 Half Yearly Examination

HSC Course

Physics

General Instructions

- Reading time – 5 minutes
- Working time – 1 hour
- Write using blue or black pen
- Draw diagrams using pencil
- Approved calculators may be used
- Write your name on each answer sheet

Total marks   40

Section A   10 multiple choice worth 1 mark each
Section B   Short answer questions worth 30 marks

TIC: D Coombes

Data and equations

Speed of light in a vacuum is 3×10^8 ms^{-1} Speed of sound in air $= 340$ ms^{-1}

Force of gravity on Earth is 9.8 N kg^{-1}

$$v_{av} = \frac{\Delta r}{\Delta t}$$
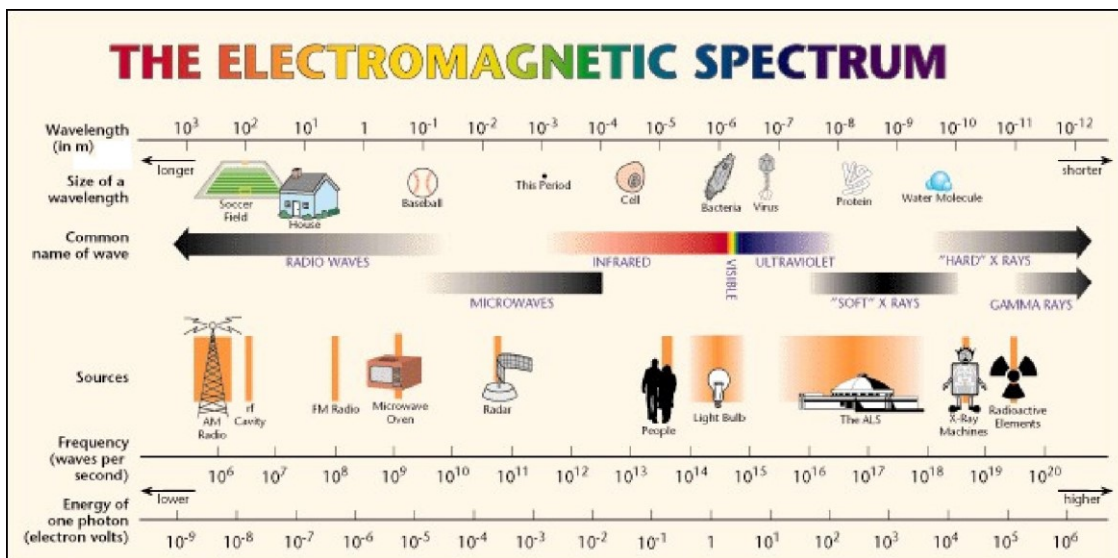
$$n = \frac{\sin i}{\sin r} = \frac{c}{v}$$

$$v = f\lambda$$

$$T = \frac{1}{f}$$

Section A
10 multiple choice questions worth one mark each

Use the following chart, which shows information about the components of the electromagnetic spectrum, to answer the next two questions.

1. Waves having wavelengths less than about 4×10^{-7} metres are **not** used for communication of information. Which of the following types of electromagnetic waves are not used for communication?

    (A) Ultraviolet

    (B) Gamma

    (C) Visible light

    (D) Radio

2. Mobile telephones use waves in the electromagnetic spectrum with a frequency of 900 megahertz.

    What is the wavelength, in metres, of the waves used by mobile telephones?

    (A) 3×10^2

    (B) 3×10^{-1}

    (C) 3×10^{-2}

    (D) 9×10^8

3. The following diagram shows a light source in air directing a beam of light onto a glass prism. The beam enters the prism at X and travels along the path YZ as shown. The normal at the point where the light strikes the prism surface is the line perpendicular to the surface. The normal at X is shown on the diagram.
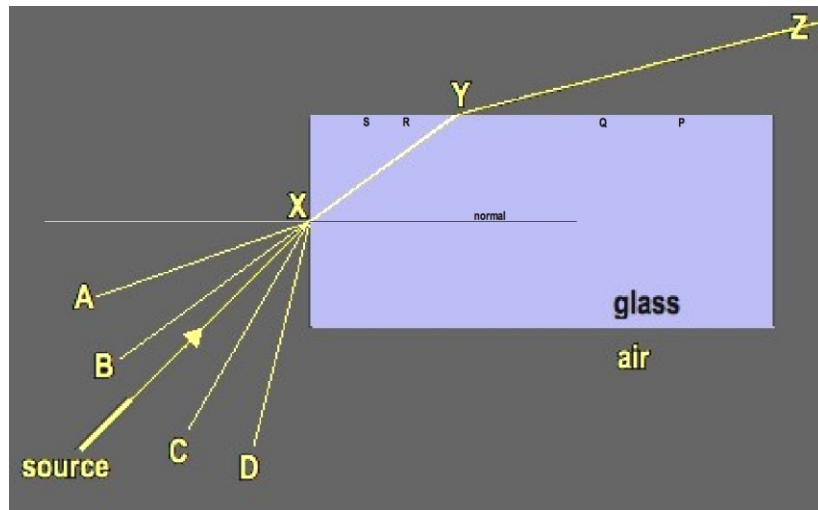
    A ray of light entering the glass prism along the path AX strikes the internal surface of the glass prism at P. Similarly, rays coming from B, C and D strike the prism at Q, R and S respectively.

    Which of the rays is most likely to be internally reflected after entering the prism and striking the upper surface?

    (A) A

    (B) B

    (C) C

    (D) D

4.   Satellite television services are transmitted from satellites placed in orbit approximately 36000 km above the equator. Dishes are placed on houses to receive these satellite broadcasts.

Which of the following is the best statement about the dish?

(A)   The dish is a convex reflector that concentrates the microwave signals.

(B)   The dish focuses signals in a narrow beam back to the satellite.

(C)   The dish reflects weak signals from the satellite onto the microwave antenna.

(D)   The dish acts as an extended antenna because microwaves have long wavelengths.

5.   The following diagram represents a sound waves being analysed using a cathode ray oscilloscope.
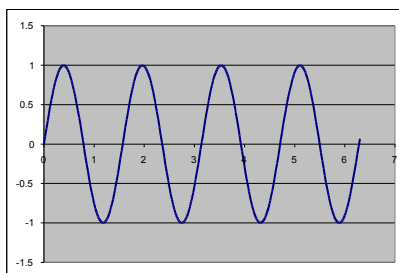
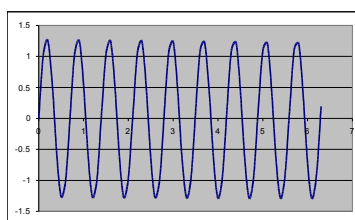Compared to the sound represented by the graph above, which graph below represents a softer sound with a higher frequency?
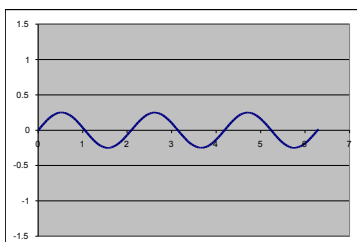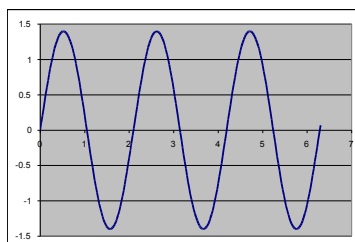
(A)   (B)

(C)   (D)
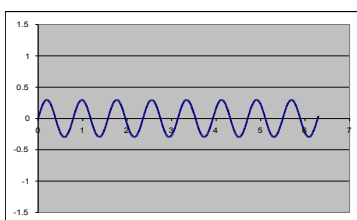
6. The light intensity from two identical stars, A and B, is measured from the Earth. Light from the star B is measured to have 16 times the intensity as coming from star A. The star A is one million light years from Earth. How far from Earth is the star B?

    (A)   4 million light years

    (B)   62 500 light years

    (C)   250 000 light years

    (D)   16 million light years

7. An electromagnetic wave has a frequency of 5×10^9 Hz. The wavelength of this wave is closest to

    (A)   6 m

    (B)   60 cm

    (C)   6 mm

    (D)   6 km

8. A sailor at sea carefully observes the crests of the waves passing his ship.

    The time between successive crests is 15 s. The height of the waves is 7 m and the distance between the crests is about 45 m. Ignoring any motion of the boat, the speed of the waves is closest to which of the following values?

    (A)   3 ms^{-1}

    (B)   675 ms^{-1}

    (C)   10 ms^{-1}

    (D)   6.4 ms^{-1}

9. Jill wants to calculate the distance from her position to a large cliff. She fires a starting gun and times how long it takes for the echo to return. Sound travels at 340 ms^{-1}. It takes 0.05 minutes for the echo to return. Calculate the distance to the cliff in kilometres. The distance is closest to

    (A)   0.17 km

    (B)   5.1 km

    (C)   1.02 km

    (D)   0.1 km

10. Which of the following is not an example of a three dimensional wave

    (A) Sound waves from a starting gun

    (B) Radio waves from NOVA FM's antenna

    (C) Light rays from candle

    (D) Water ripples from an insect fallen onto the water surface

Section B

This section is worth 30 marks.

Attempt all questions.

11. The apparatus shown the in the photograph below was used to conduct a first-hand investigation of the properties and behaviour of light and the graph shows the data collected during this investigation.
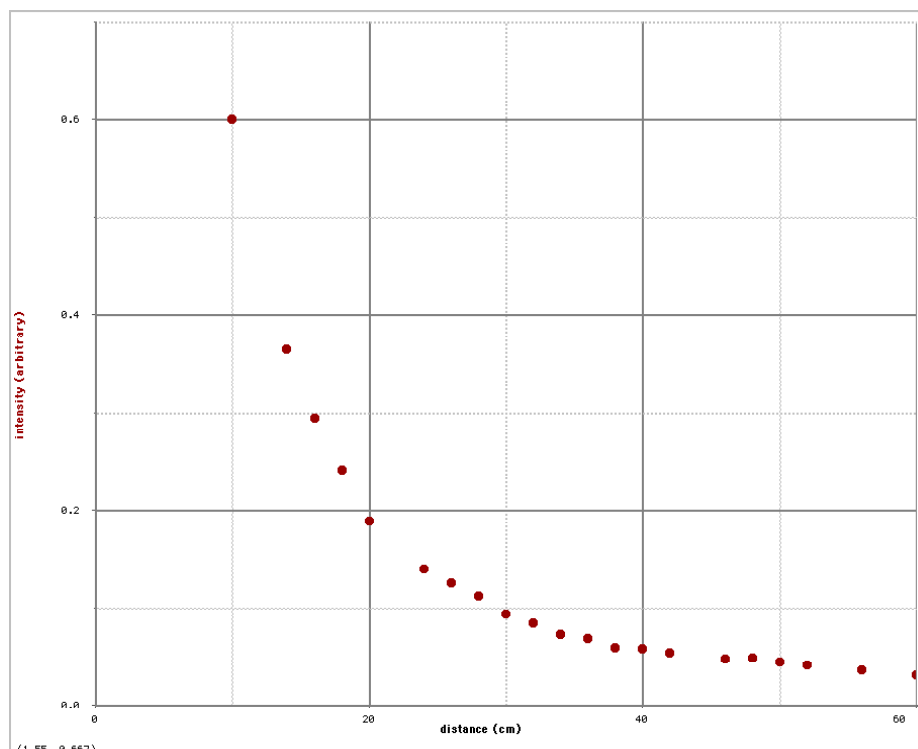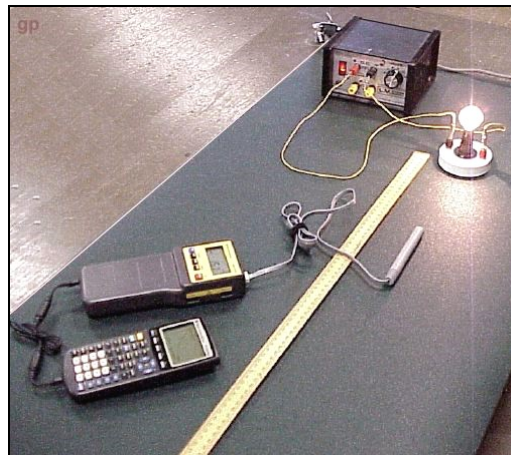
(a) Propose the **aim** of this investigation. **(1 mark)**

(b) Describe in words the relationship between the variables measured that is evident from this graph. **(1 mark)**

(c) Suggest another graph that could be constructed to enable the mathematical relationship between these variables to be deduced. **(1 mark)**

12. The following image shows a ray of light travelling through a glass prism in a vacuum. A protractor has been superimposed on the image.
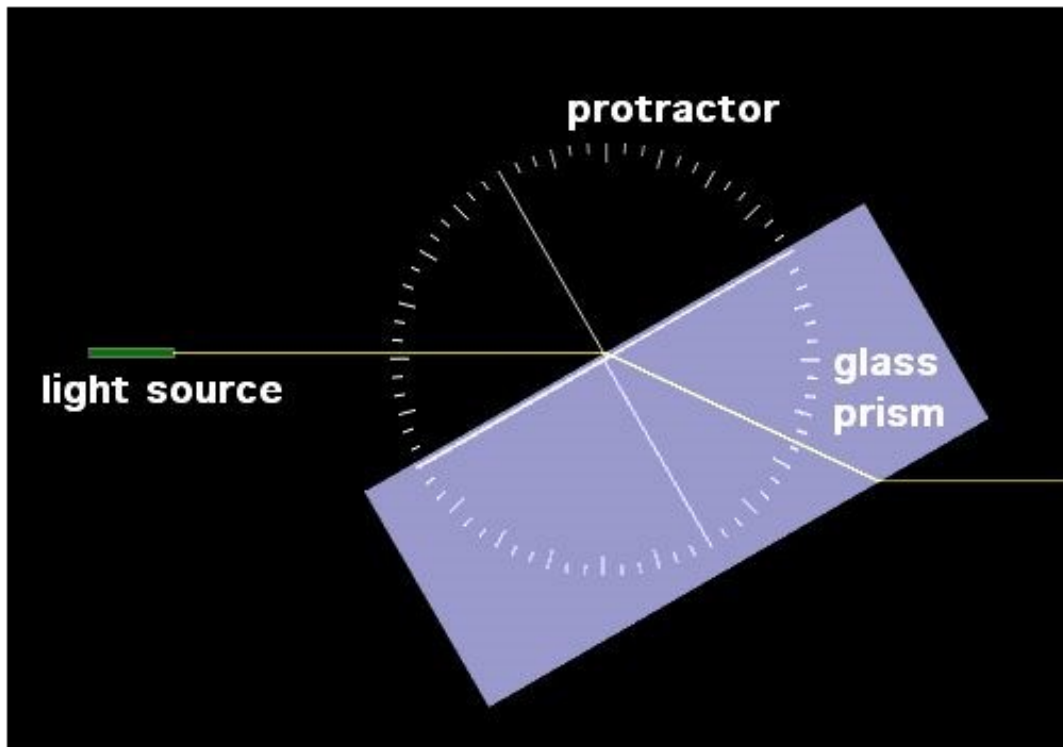
(a) Calculate the refractive index of the glass prism? **(2 marks)**

(b) Calculate the critical angle for light within the prism. **(2 marks)**

13. Outline the energy transformations required in one of the following:
    – mobile telephone
    – fax/modem
    – radio or television   **(2 marks)**

14. The image below is a photograph of the swimming pool at Hurlstone viewed from an angle.

With the aid of a labelled diagram show the path of the light travelling from the lines at the far end of the pool to the camera used to take the photograph and identify the wave phenomenon which is responsible for the behaviour of the light that you have illustrated.

(2 marks)

15. The following is a pressure / time graph representation produced by the Audacity program to examine the sound produced by a kalinda (a musical instrument). Calculate the frequency and wavelength of the sound wave represented by this graph. **(3 marks)**
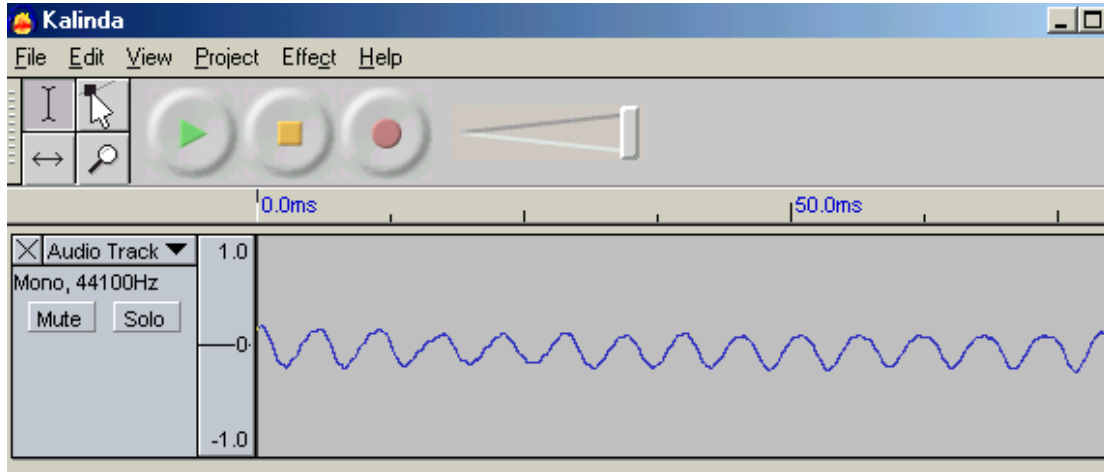
16. The following diagram shows a cross-sectional view of an optical fibre.
Using a suitable diagram, show the relationship between the critical angle and the ray reflected ray in the fibre. **(2 marks)**
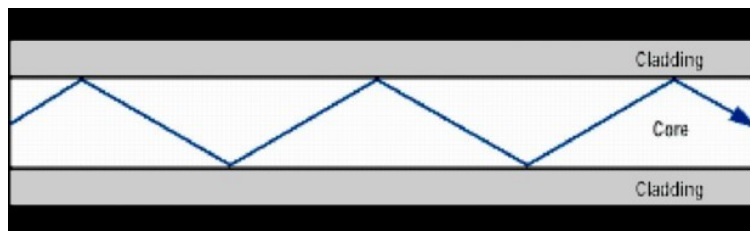
17. The following diagram shows a modulated radio wave.
(a) Identify the type of modulation represented by this graph. **(1 mark)**
(b) Outline the process that would enable this wave to be produced. **(3 marks)**
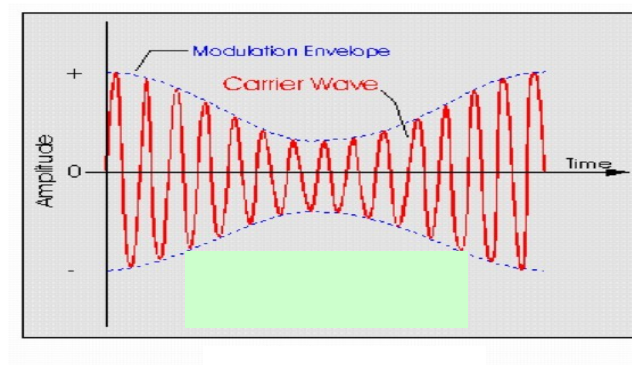
18. An investigation of the relationship between frequency and wavelength for a sound wave was carried out. The following data was collected by Johnny in this investigation.

Frequency (Hz)	Wavelength (cm)	1/wavelength (m^{-1})
1700	20	
860	40	
570	60	
410	80	
350	100	
290	120	
240	140	
200	160	
190	180	

  (A) Using the table above plot a graph of frequency vs 1/wavelength. **(4 marks)**

  (B) Identify the relationship between frequency and wavelength. **(1 mark)**

19. Waves can be broadly classified into two groups, electromagnetic and mechanical. Compare electromagnetic with mechanical waves using two specific examples**.** **(2 marks)**.

20. Assess the impact of physics on society with reference to one technology that has become widespread in the last 20 years**. (3 marks)**.

[end of paper]

Answer Sheet   Name

Section A Answer Sheet

Use of the multiple-choice answer sheet.

Select the alternative A, B, C or D that best answers the question and fill in the response oval completely.

Sample   2 + 4 = (A) 2 (B) 6 (C) 8 (D) 9

1.   (A) ⬭   (B) ⬤   (C) ⬭   (D) ⬭

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

1.   (A) ⬤   (B) ⊗   (C) ⬭   (D) ⬭

If you change your mind and have crossed out what you consider to be the correct answer, then indicate this by writing the word correct and drawing an arrow as follows:

correct
↓

1.   (A) ⊗   (B) ⊗   (C) ⬭   (D) ⬭

Total marks (10)

Attempt all questions 1 – 10

1.   (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

2.   (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

3.   (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

4.   (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

5.   (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

6.   (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

7.   (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

8.   (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

9.   (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

10.   (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭