Write your name here

Surname	Other names

Pearson BTEC Level 3 Nationals Certificate

Centre Number

Learner Registration Number

Applied Science

Unit 1: Principles and Applications of Science I

Physics

SECTION C: WAVES IN COMMUNICATION

Friday 25 May 2018 – Afternoon

Time: 40 minutes

Paper Reference

31617H/1P

You must have:
A calculator

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and learner registration number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The exam is comprised of three papers worth 30 marks each.
  Section A: Structures and functions of cells and tissues (Biology).
  Section B: Periodicity and properties of elements (Chemistry).
  Section C: Waves in communication (Physics).
- The total mark for this exam is 90.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- The formulae sheet can be found at the back of this paper.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

P61073A

1/1/1/1

P 6 1 0 7 3 A 0 1 1 2

Pearson

Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 Longitudinal and transverse are two types of wave.

(a) (i) Give an example of a longitudinal wave.

(1)

.....

(ii) Describe how a longitudinal wave travels through air.

(2)

.....

.....

.....

.....

Figure 1 shows a transverse wave.

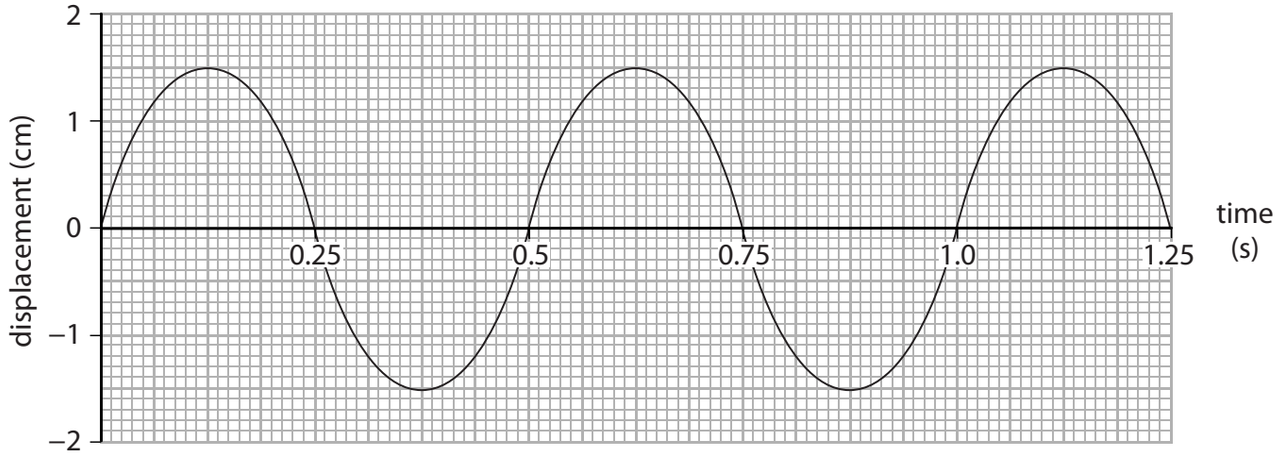

Figure 1

(b) (i) Give the frequency of the wave.

(1)

frequency = ... Hz

(ii) In Figure 2, each diagram shows two points on a transverse wave.

(1)

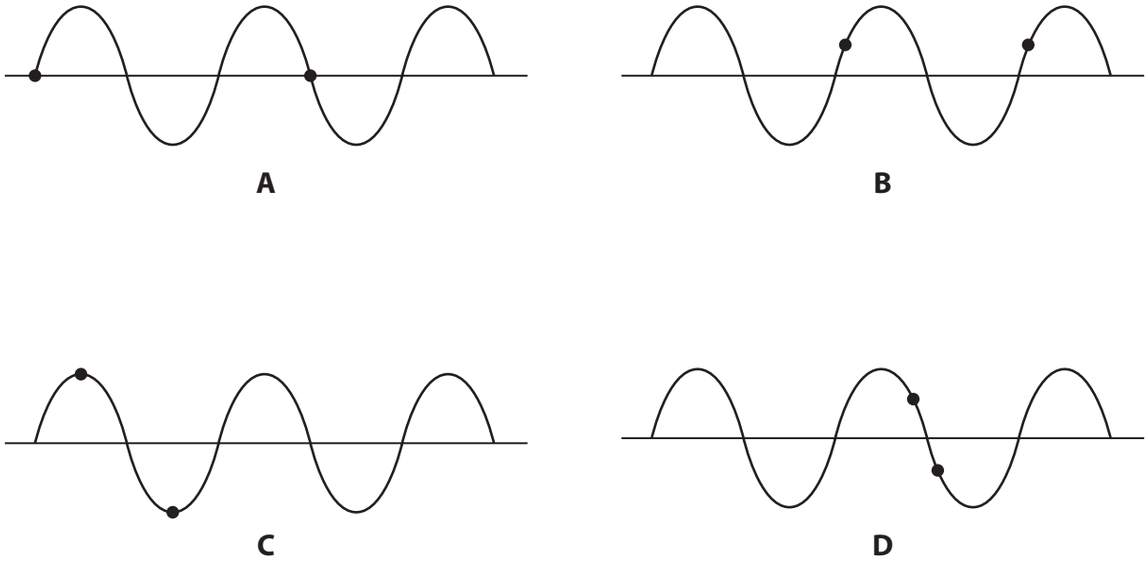

Figure 2

Which diagram shows two points that are in phase?

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(Total for Question 1 = 5 marks)

2 (a) State **one** type of electromagnetic wave used in satellite communication.

(1)

.....

(b) Television remote controls use infrared radiation to send information.

(i) Explain **one** advantage of using infrared radiation to control a television.

(2)

.....

.....

.....

.....

(ii) Explain **one** disadvantage of using infrared radiation to control a television.

(2)

.....

.....

.....

.....

(Total for Question 2 = 5 marks)

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE

3 A doctor uses an endoscope to view the lining of a patient's stomach, as shown in Figure 3.

An endoscope contains optical fibres.

Light travels down the optical fibres to illuminate the stomach.

Not to scale

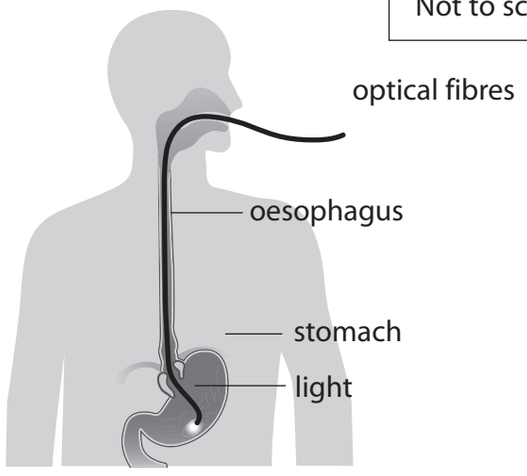

Figure 3

(a) Explain how light travels back through the endoscope so an image of the lining of the patient's stomach can be seen. You may use diagrams to support your answer.

(4)

(b) (i) The speed of light in the air is approximately $3 \times 10^8\,ms^{-1}$.

State how the speed of the light changes in the optical fibres.

(1)

.....

(ii) The glass used in the optical fibres has a refractive index of 1.495.

Calculate the critical angle of the glass used in the optical fibres.

Use the equation $\sin C = \frac{1}{n}$

Show your working.

(3)

critical angle ..... °

(Total for Question 3 = 8 marks)

4 A diffraction experiment makes use of coherent light waves.

(a) Describe what is meant by the term **coherent light waves**.

(2)

(b) A technician wants to identify the gas in a discharge tube.

The technician uses a diffraction grating to produce emission spectra for the gas.

Each spectrum consists of a series of light and dark lines on a screen.

Explain how the diffraction grating produces the light and dark lines on the screen. You may draw diagrams to support your answer.

(6)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(c) The light that produces one of the lines on the screen has a wavelength of 588.2 nm.

Calculate the frequency of this light.

Speed of light in air = 3.0×10^8 ms^{-1}

Show your working.

(4)

frequency = ...Hz

(Total for Question 4 = 12 marks)

TOTAL FOR PAPER = 30 MARKS
TOTAL FOR EXAM = 90 MARKS

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE

Formulae Sheet

Wave speed $v = f\lambda$

Speed of a transverse wave on a string $v = \sqrt{\frac{T}{\mu}}$

Refractive index $n = \frac{c}{v} = \frac{\sin i}{\sin r}$

Critical angle $\sin C = \frac{1}{n}$

Inverse square law in relation to the intensity of a wave $I = \frac{k}{r^2}$

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA