Barrhead High School
Physics Department

N4/5 Physics

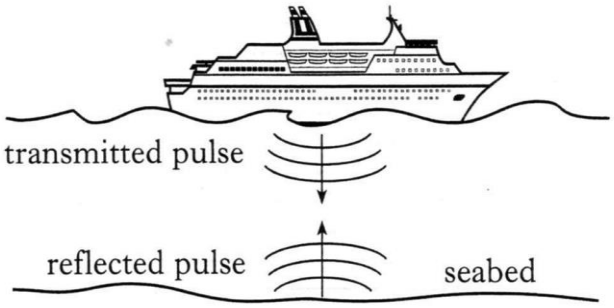
Waves & Radiation
Exam Questions
Homework

Name

Homework Record			
Homework	**Date due**	**Mark %**	**Sign**
1			
2			
3			
4			
5			
6			
7			

Homework 1

1 The depth of the seabed is measured using pulses of ultrasound waves. The ultrasound waves are transmitted from a stationary ship. The waves are reflected from the seabed as shown and are detected by equipment on the ship. The transmitted ultrasound waves have a frequency of 30 kHz.



a) (i) Use the data sheet to find the speed of the ultrasound waves in the water. 1

If the time taken for the wave to be detected is 0.5s

(ii) Calculate the depth of the seabed. 4

(iii) Calculate the wavelength of the ultrasound waves in the water. 3

b) The frequency of the transmitted wave is increased to 60 kHz.

What happens to the time interval between the transmitted pulse and the reflected pulse?

Explain your answer. 2

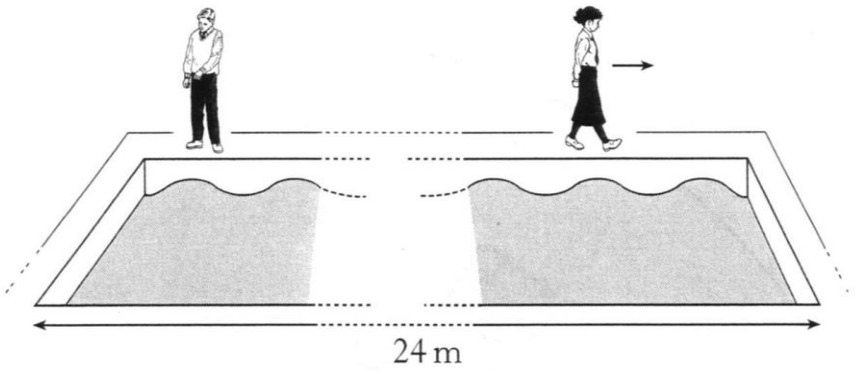
c) How will the amplitude of the reflected wave compare with the transmitted wave?

Explain your answer. 2

total 12

Homework 2

1 Two students watch the waves produced by a wave machine at a swimming pool.



One student walks beside a wave as it travels along the pool. The wave goes from one end of the pool to the other in 20 s. The length of the pool is 24 m.

a) Calculate the speed of the waves. 3

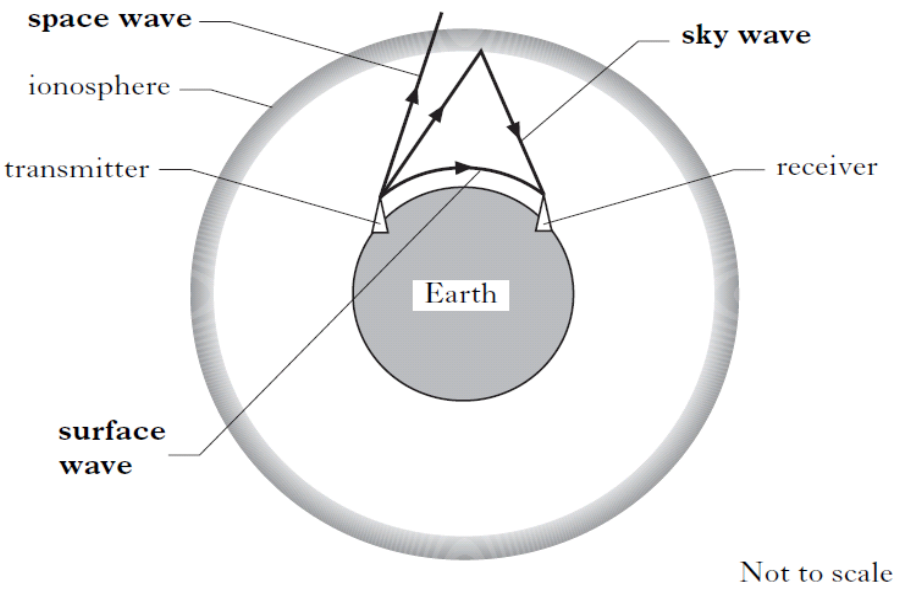
b) In the same time interval, the other student counts 5 waves going past the point where he is standing.

Calculate the frequency of the waves. 2

c) The students note that there are 5 complete waves in the pool at any time.

Calculate the wavelength of the waves. 2

d) The diagram shows how radio signals of different wavelengths are sent between a transmitter and a receiver.



Not to scale

i) Which of the waves in the diagram shows diffraction? 1

Homework 3 continued

ii) What does this indicate about the wavelength and frequency of the diffracted wave compared to the other two waves?

2

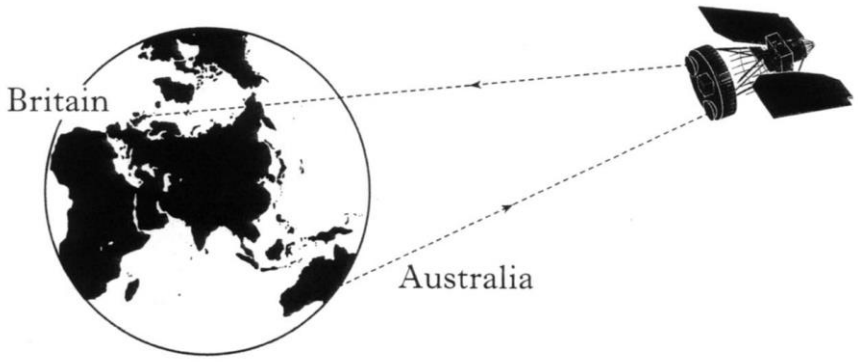
iii) The Earth's ionosphere is shown on the diagram. The ionosphere is a layer of charged particles in the upper atmosphere. High frequency waves are transmitted as sky waves.
Explain how the transmitted waves reach the receiver.

1

total 11

Homework 3

1 Radio signals from the Olympic Games in Australia are transmitted to Britain. The signals are sent at a frequency of 6 GHz (6×10^9 Hz) to a satellite which is in a geostationary orbit. Using a different frequency, the satellite then retransmits the signals to a ground station in Britain.



a) Calculate the wavelength of the signals which are sent to the satellite. 3

b) One of the layers in the atmosphere is the ionosphere. The radio signals pass through the ionosphere as they travel between Earth and the satellite. Radio waves of frequencies below 30 MHz are reflected by the ionosphere.

Circle the frequency that is suitable for **retransmitting** the signals from the satellite to the Earth.

20 MHz 4 GHz 6 GHz 1

c) Gamma rays, ultraviolet and infrared are three members of a family of waves. Every member of this family travels at the speed of light.

i) What is the name given to this family of waves? 1

ii) Give one use each for the following radiation
Gamma
Ultraviolet
Infrared 3

iii) Which of the 3 radiations above has
The biggest wavelength?
The highest frequency? 2

total 10

Homework 4

1 The table below gives information on some types of lasers

Type of laser	*Wavelength* (nm)	*Output power* (W)
Krypton fluoride	248	1·0
Argon	488	2·0
Helium neon	633	0·005
Rhodamine	570 to 650	50·0
Carbon dioxide	10 600	200·0

The visible spectrum has wavelengths ranging from 400nm to 700nm

a) Name one type of laser from the table that emits visible radiation 1

b) Name one type of laser from the table that emits ultraviolet radiation 1

c) Name the laser from the table that has the highest frequency. 1

d) Name the laser from the table that has highest energy.
Explain your answer. 2

e) Calculate the frequency for the laser in part (c). 3

2

a) How does the speed of visible light in air compare to the speed of light in glass. 1

b) Give an example of a detector of visible light. 1

total 10

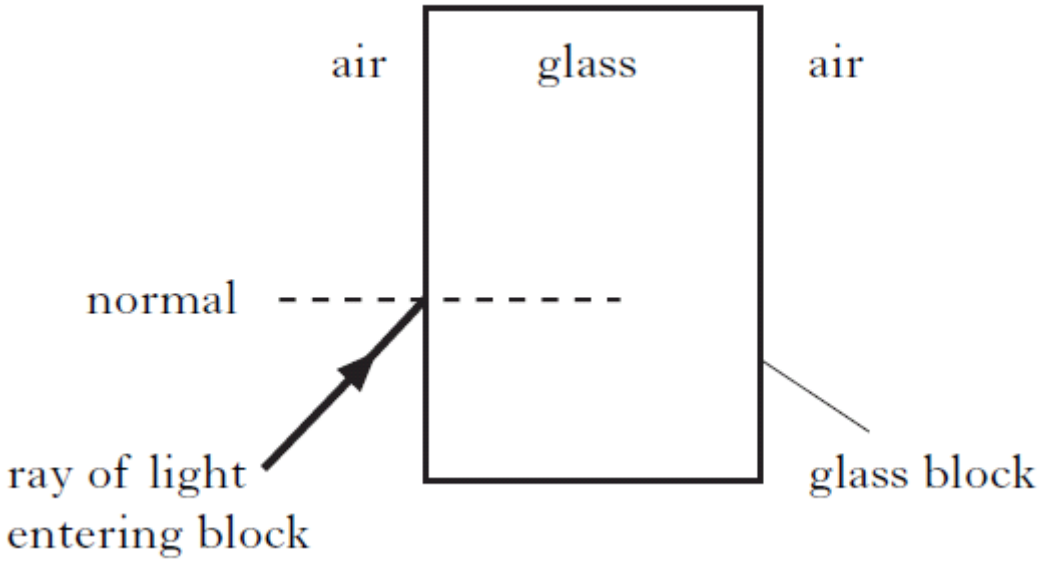
Homework 5

1 Light can be refracted. Explain fully what his means. 2

2 The following diagram shows a ray of light entering a glass shape.

Complete the diagram to show the path of the ray of light through the following shapes until it leaves the shape.

a)



2

b) Mark an angle of refraction in above diagram with the letter r 1

2 Mr Malloy's favourite pastime is to read marking instructions for physics exams but lately the writing appears a little blurry to Mr Malloy.

a) What eye defect is Mr Malloy suffering from? 1

b) Draw a ray diagram of light travelling in an eye which has the defect in Q2a). 1

c) Draw a ray diagram of how the above defect can be fixed. Any parts outside of the eye must be labelled. 2

d) Draw a ray diagram for a lens that is not the lens used in Q2c) 1

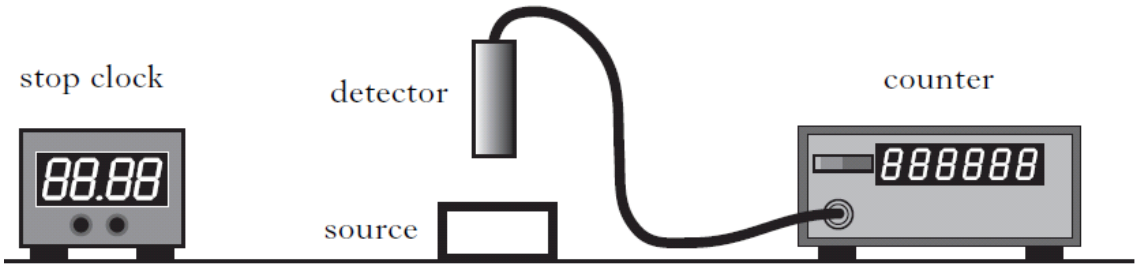
total 10

Homework 6

1

a) What is meant by ionisation? 1

b) Students observe an experiment with radioactive sources. The radiation is measured using a detector and counter. The background count rate is measured.



Different absorbing materials are then placed, in turn, between source and detector and readings for each material are recorded. This is repeated for each source. The results are shown in the table.

	Corrected Count Rate (Counts per minute)			
Source	*No absorbing material*	*Paper*	*2 cm of Aluminium*	*2 cm of Lead*
A	480	480	480	200
B	720	300	300	180
C	600	580	0	0

One source emits beta radiation only, one emits gamma only and one emits both alpha and gamma radiation.

Which of the sources above emits

i) Beta radiation only 1

ii) Both alpha and gamma 1

c) Calculate the activity of source A above 3

2

a) Equivalent dose measures the biological effect of radiation.
State the unit for equivalent dose. 1

b) For living material the biological effect of radiation depends on a number of factors.
State **two** of these factors. 2

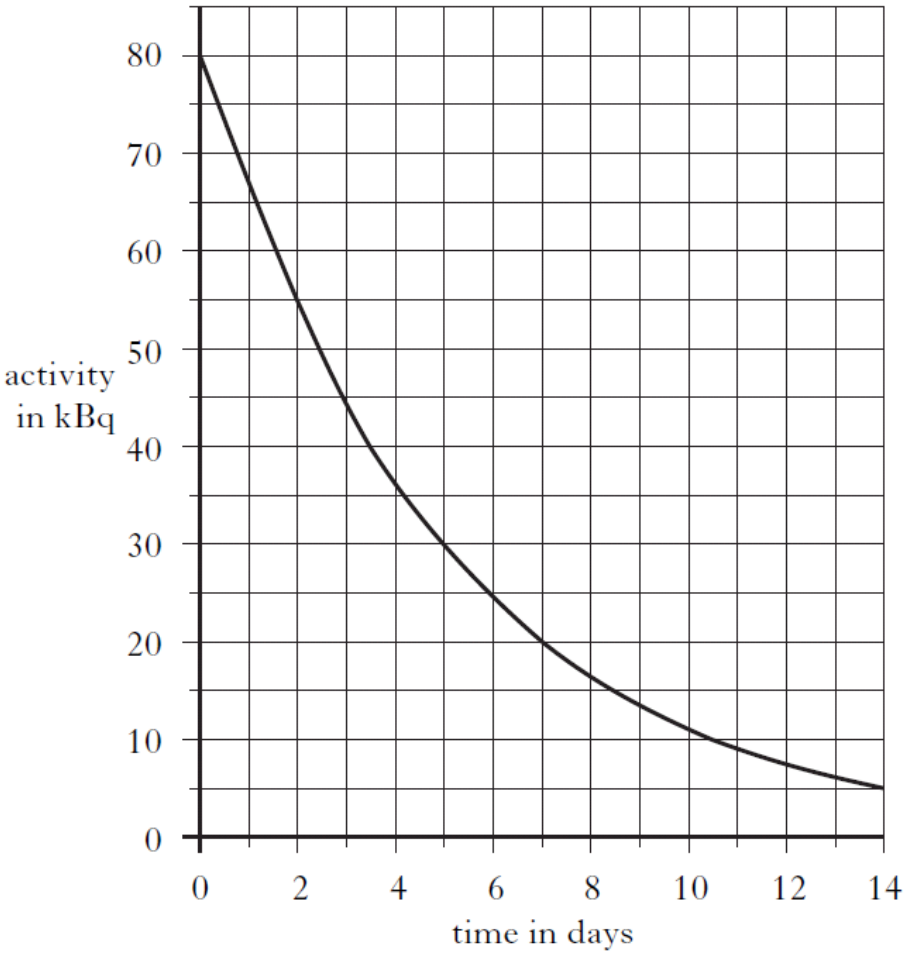
c) A technician working with a radioactive source receives an absorbed dose of 4μGy .
The radiation weighting factor for this radiation is 20
Calculate the equivalent dose received by the technician. 3

total 12

Homework 7

1

a) A radioactive source is used for medical treatment. The graph shows the activity of this source over a period of time.



(*a*) Use information from the graph to calculate the half-life of this source. 1

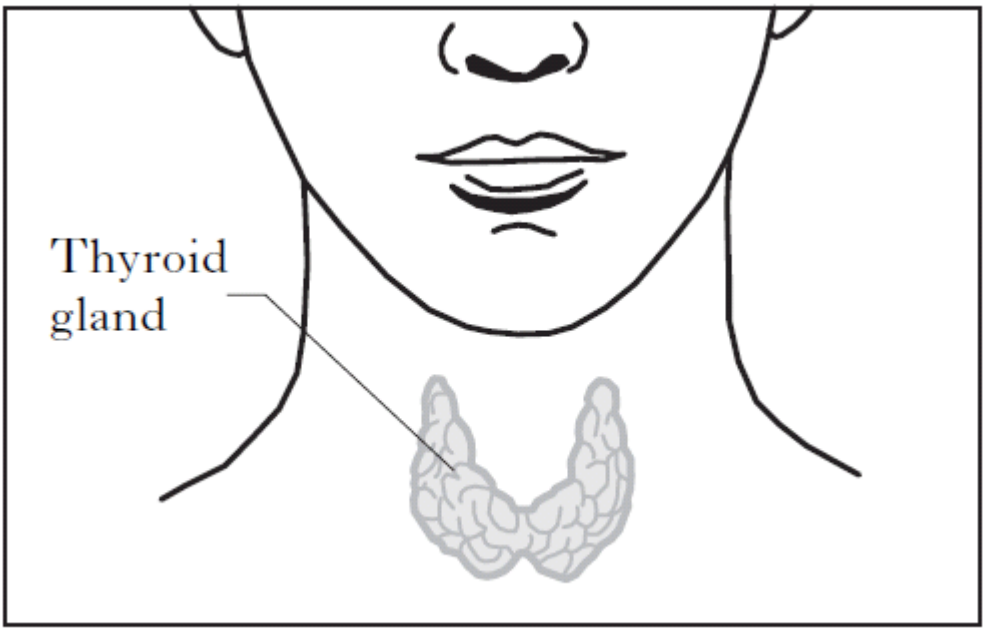
b) A sample of this source is to be given to a patient at 9.30 am on May 17. When the sample is prepared, its initial activity is 200 kBq. The activity of the sample when given to the patient must be 12·5 kBq.

Calculate at what time and on what date the sample should be prepared. 3

c) Describe a method that can be used to measure the half life of a source.
List the apparatus needed and measurements taken 3

Homework 7 continued

2 The thyroid gland, located in the neck, is essential for maintaining good health.



a) A radioactive source, which is a gamma radiation emitter, is used as a radioactive tracer for the diagnosis of thyroid gland disorders.

A small quantity of this tracer, with an activity of 20 MBq, is injected into a patient's body. After 52 hours, the activity of the tracer is measured at 1·25 MBq.

Calculate the half life of the tracer. 2

b) Another radioactive source is used to **treat** cancer of the thyroid gland. This source emits only beta radiation.

Why is this source unsuitable as a **tracer**? 1

c) The equivalent dose is much higher for the beta emitter than for the gamma emitter.

State a reason why. 1

total 11