Tianjin Yinghua Cambridge International School (TYCIS)

2021 – 2022 Cambridge International Mock Exams

CENTRE NUMBER CN884

English Name	Chinese Name	Total Mark (For teacher's use only)
		/80

PHYSICS **0625**

Paper 2, 4, & 6 (Combined) **1.5 hr (90 min.)**

2021-2022 SEMESTER1

READ THESE INSTRUCTIONS FIRST

Write your work in dark blue or black pen.
This exam paper contains *3 sections*, and *38 questions* in total. The total number of marks for this paper is 80.

Section I: multiple choice (Q1 - 20), *20 marks* in total

Section II: Structured questions (Q21 - 36), *40 marks* in total

Section III: Alternative to practical (Q37 - 38), *20 marks* in total

Answer **all** questions.

Calculators, rulers, and protractors are allowed to be used.

You may **lose marks if you do not show your working or if you do not use appropriate units**.

The number of marks is given in brackets [ ] at the end of each question or part question.

Section I	/20
Section II	/40
Section III	/20

Turn over

Subject Teacher: C. Chu

Section I: Multiple Choice [Total: 20]

1 A steel ball is fired vertically upwards with a velocity v. The ball reaches a height h.

The same ball is now fired vertically upwards from the same position with a velocity $2v$.

Air resistance can be ignored.

What is the new height reached by the ball?

A h **B** $2h$ **C** $4h$ **D** $8h$

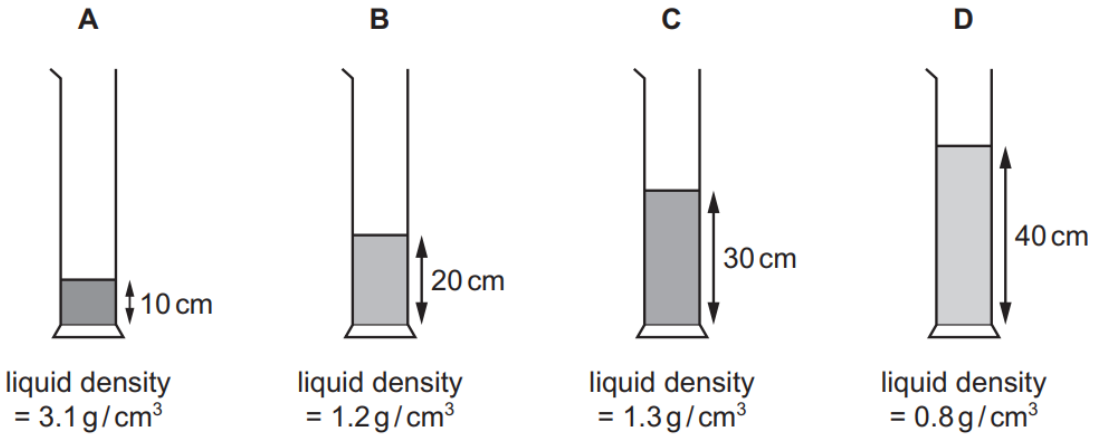
[1]

Ans. _____

2 Four different liquids are poured into four containers.

The diagrams show the depth and the density of liquid in each container.

In which container is the pressure on its base the greatest?



[1]

Ans. _____

3 A student uses an immersion heater to heat some water in a beaker.

The water is heated from 20 °C to 80 °C.

The energy supplied to the water is 60.0 kJ.

What is the thermal capacity of the water? (Ignore any heat loss.)

A 667 J / °C **B** 750 J / °C **C** 1000 J / °C **D** 3000 J / °C

[1]

Ans. _____

4 A skydiver reaches terminal velocity. Then he opens his parachute.

What happens to the skydiver as the parachute opens?

A There is a decrease in weight.

B There is acceleration upwards.

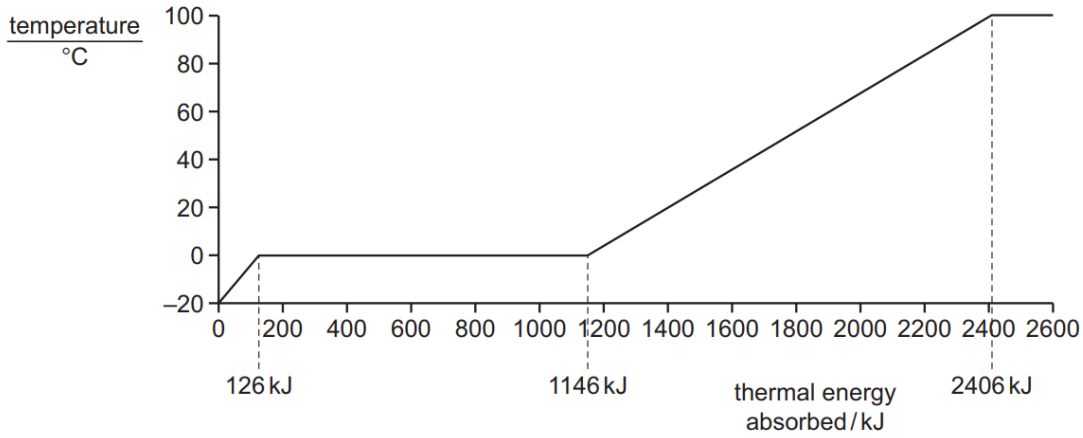
C There is an increase in speed.

D There is movement upwards.

[1]

Ans. _____

5 A block of ice at −20 °C is heated until it turns to steam. The graph of temperature against thermal energy absorbed is shown. The latent heat of fusion of ice is 340 kJ / kg.



What is the mass of ice?

A 1.0 kg **B** 2.0 kg **C** 3.0 kg **D** 4.0 kg

[1]

Ans. _____

6 Which wavefront is travelling at a speed closest to that of a sound wave through a solid?

A one that moves 10 m in 0.01 s

B one that moves 50 m in 0.5 s

C one that moves 1000 m in 100 s

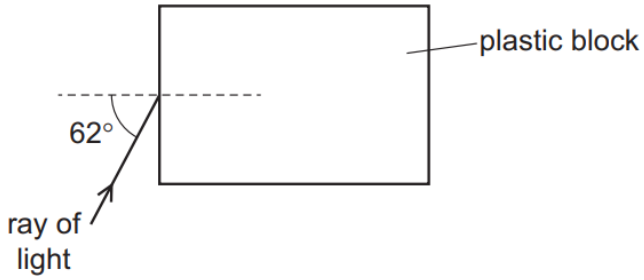
D one that moves 2000 m in 2000 s

[1]

Ans. _____

7 Light travelling in air enters a plastic block at an angle of incidence of 62°.

The plastic has a refractive index of 1.48.



What is the angle of refraction?

A 18° **B** 28° **C** 37° **D** 42°

[1]

Ans. _____

8 Water of mass 100 g at a temperature of 100 °C is converted into steam at 100 °C. The specific latent heat of vaporisation of water is 2300 J / g.

How much thermal energy is absorbed by the water?

A 23J **B** 230 J **C** 230 000 J **D** 23 000 000 J

[1]

Ans. _____

9 A person uses a surfboard to ride every 30th wave crest towards the beach. The wave crest travels at a speed of 1.6 m/s and the distance between each wave crest is 24 m.

How many wave crests does the person surf in one hour?

A 1 **B** 2 **C** 8 **D** 450

[1]

Ans. _____

10 Sound waves of frequency 2.0 kHz travel through a substance at a speed of 800 m /s.

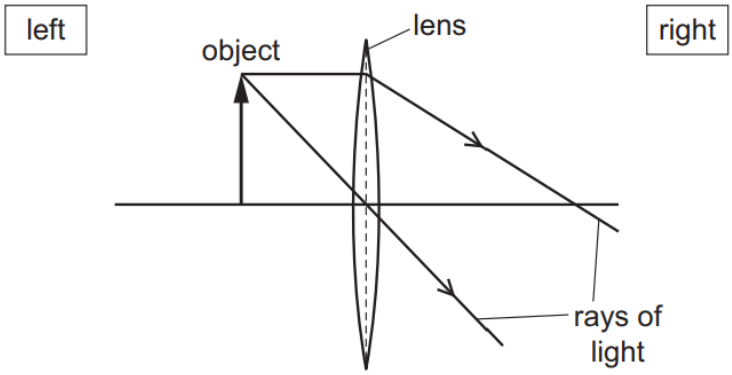
What is the wavelength of the waves?

A 0.40 m **B** 2.5 m **C** 400 m **D** 1600 m

[1]

Ans. _____

11 The incomplete ray diagram shows two rays of light that have passed from one point on an object through a thin converging lens.



Which type of image is formed, and on which side of the lens is it formed?

	type of image	which side of lens
A	real	on the left
B	real	on the right
C	virtual	on the left
D	virtual	on the right

[1]

Ans. _____

12 Radioactive carbon-14 decays to nitrogen-14 by the emission of a particle.

$$^{14}_{6}\mathrm{C} \rightarrow {}^{14}_{7}\mathrm{N} + \text{particle}$$

Which particle has been emitted in this process?

A a β -particle

B an α -particle

C a neutron

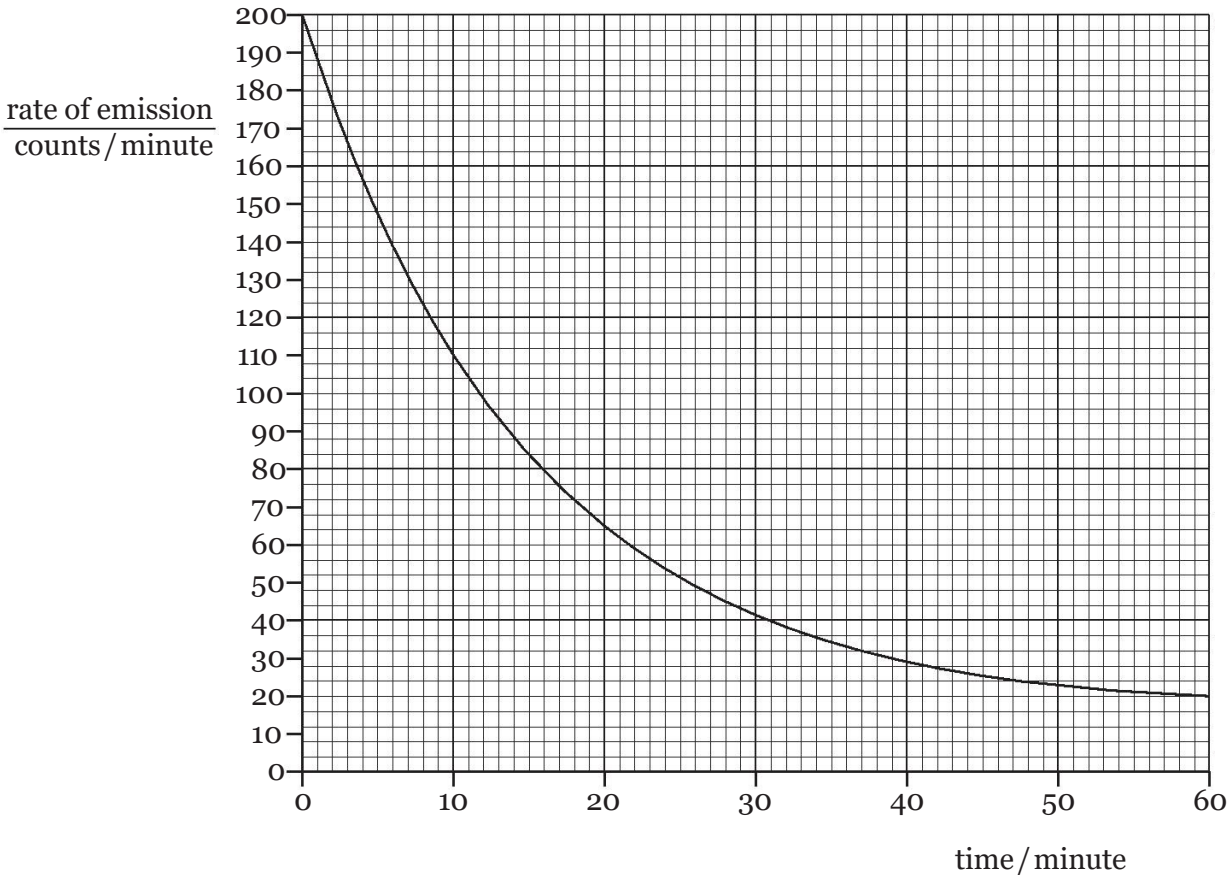
D a proton

[1]

Ans. _____

13 The rate of emission of a radioactive source is measured until the reading reaches the background rate of 20 counts per minute.

The results are shown.



What is the best estimate of the half-life of the source?

A 10 minutes

B 12 minutes

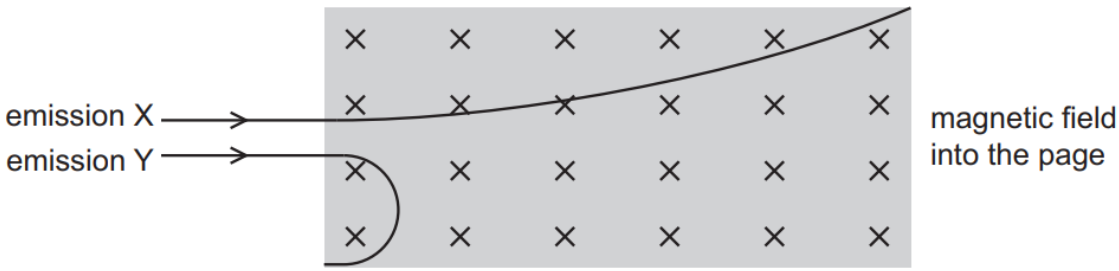
C 14 minutes

D 30 minutes

[1]

Ans. _____

14 Emissions X and Y from radioactive material are passed through a magnetic field. The diagram shows the direction of the emissions, the direction of the magnetic field and the effect on the emissions.



Which type of emission is X, and which type of emission is Y?

	emission X	emission Y
A	α-particles	β-particles
B	α-particles	γ-rays
C	β-particles	α-particles
D	β-particles	γ-rays

[1]

Ans. _____

15 A metal has a specific heat capacity of 360 J / (kg °C). An object made of this metal has a mass of 2.0 kg.

What is the thermal capacity (heat capacity) of the object?

A 180J /°C **B** 180J /kg **C** 720J /°C **D** 720J /kg

[1]

Ans. _____

16 A sample of a radioactive isotope emits particles at a rate of 240 per minute.

After 48 hours the rate of emission has decreased to 15 per minute.

What is the half-life of the radioactive material?

A 4.0 hours **B** 8.0 hours **C** 12 hours **D** 16 hours

[1]

Ans. _____

17 The equation represents an isotope of radium Ra decaying to an isotope of radon Rn with the emission of particle X.

$$^{226}_{88}\text{Ra} \rightarrow {}^{222}_{86}\text{Rn} + \text{X}$$

What is particle X?

A $^{0}_{-1}\text{e}$ **B** $^{1}_{1}\text{H}$ **C** $^{4}_{2}\text{He}$ **D** $^{1}_{0}\text{n}$

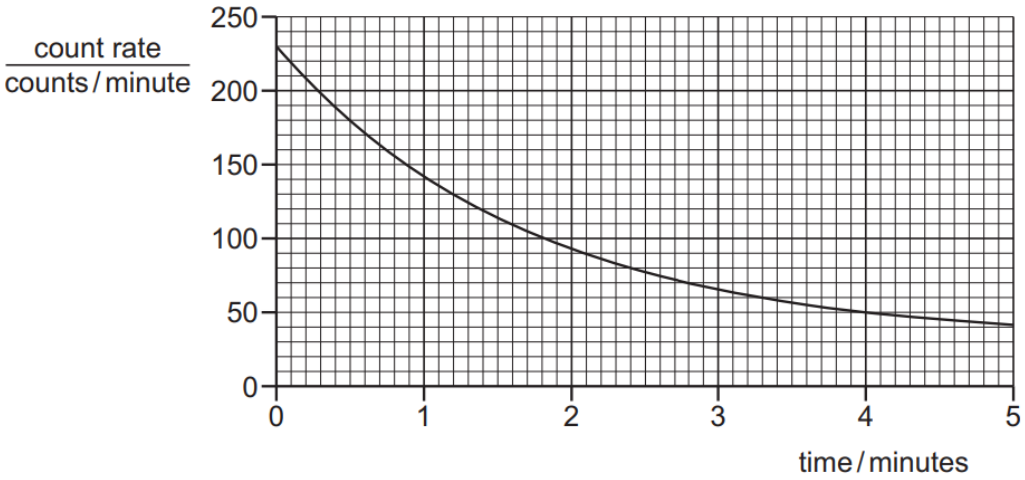
[1]

Ans. _____

18 A student determines the half-life of a radioactive isotope.

The student uses a detector over five minutes and plots a graph showing how the count rate shown on the detector varies with time.

The count rate due to background radiation is 30 counts per minute.



What is the half-life of this isotope?

A 0.30 minutes

B 1.2 minutes

C 1.5 minutes

D 5.0 minutes

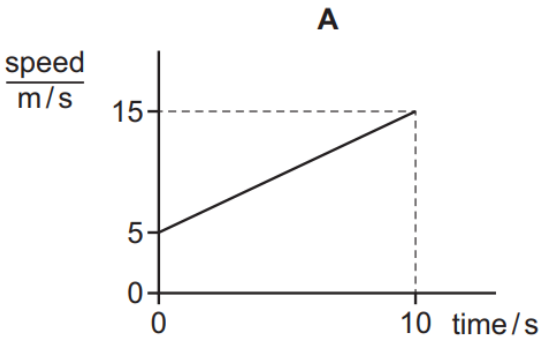
[1]

Ans. _____

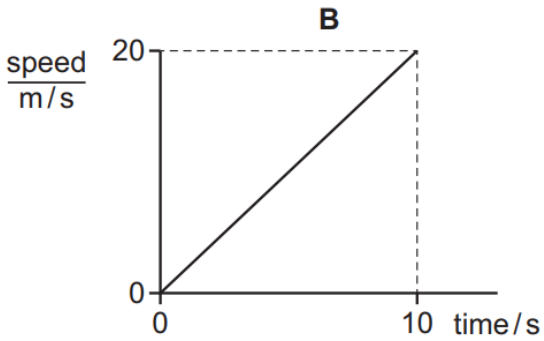
19 A car accelerates from rest and travels a distance of 100 m in 10 seconds.

Which speed-time graph represents the motion of this car?

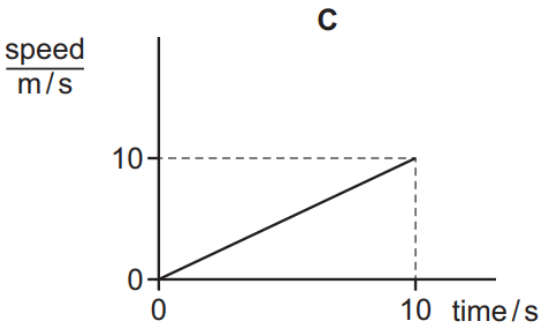
A



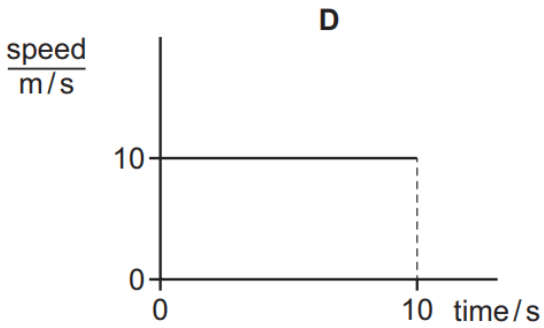
B



C



D



[1]

Ans. _____

20 Which statement about infra-red waves is correct?

Infra-red waves in the electromagnetic spectrum

A can be seen by the human eye.

B cannot travel through a vacuum.

C have the same speed as radio waves when in a vacuum.

D travel as longitudinal waves.

[1]

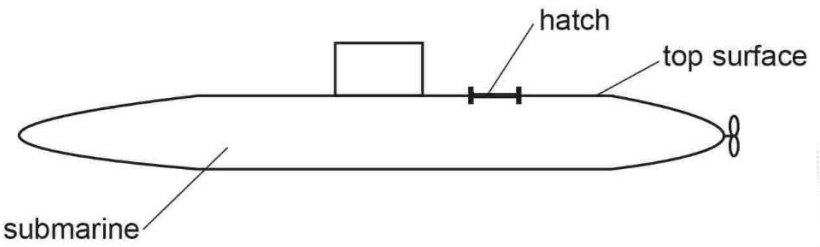
Ans. _____

END of Section I

Section I	**/20**

Section II: Structured question [40]

21 The diagram shows a submarine. The submarine is fully submerged in the sea.



The density of sea water is 1020 kg / m^3.

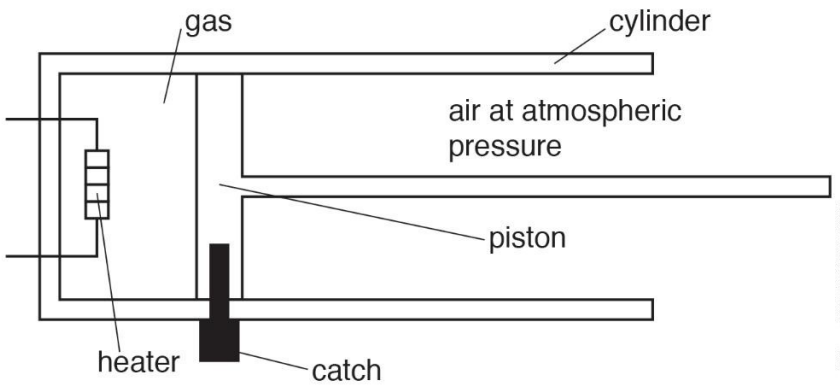
The atmospheric pressure is 100 kPa and the total pressure on the top surface of the submarine is 500 kPa.

Calculate the depth of the top surface of the submarine below the surface of the sea.

depth = ... [3]

[Total: 3]

22 Gas of mass 0.23 g is trapped in a cylinder by a piston. The gas is at atmospheric pressure which is 1.0×10^5 Pa. The diagram shows the piston held in position by a catch.



The volume of the trapped gas is 1.9×10^{-4} m^3.

An electrical heater is used to increase the temperature of the trapped gas by 550 °C.

(a) The specific heat capacity of the gas is 0.72 J / (g °C).

Calculate the energy required to increase the temperature of the trapped gas by 550 °C.

energy = ... [2]

(b) The power of the heater is 2.4 W.

Calculate how long it takes for the heater to supply the energy calculated in **(a)**.

time = ... [2]

(c) In practice, it takes much longer to increase the temperature of the gas by 550 °C using the heater.

Suggest **one** reason for this.

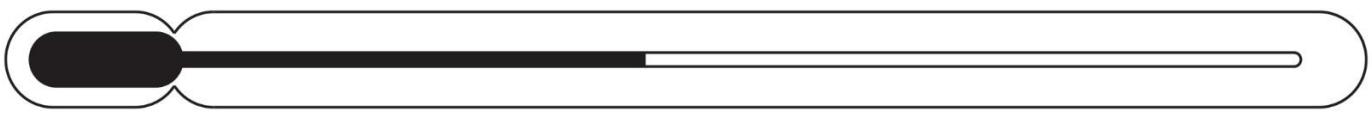
.....

.....

..... [1]

[Total: 5]

23 The diagram shows a liquid-in-glass thermometer without a temperature scale. The liquid inside the thermometer has a melting point of –39 °C.



State the property of the liquid which ensures that the scale on a liquid-in-glass thermometer is linear.

..... [1]

[Total: 1]

24 Water molecules escape to the atmosphere from water boiling in a pan. Water molecules evaporate from the surface of a bowl of cool water and also escape to the atmosphere.

State **two** ways in which boiling is different from evaporation.

1. .....

.....

2. .....

..... [2]

[Total: 2]

25 Gases can be compressed but liquids are incompressible.

Explain, in terms of molecules, why liquids are incompressible.

.....

.....

..... [2]

[Total: 2]

26 The distance between the centre of a thin converging lens and each principal focus is 5.0 cm.

The lens is used as a magnifying glass to produce an image I of an object O.

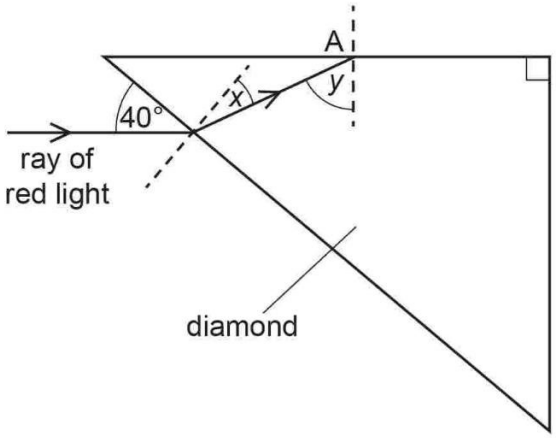
Underline the terms that describe the nature of the image produced by a magnifying glass.

diminished **enlarged** **inverted** **real** **same size** **upright** **virtual**

[2]

[Total: 2]

27 The diagram shows red light travelling from air into a prism made of diamond. The path of the red light is incomplete.



(not to scale)

The refractive index of diamond is 2.42.

Calculate angle *x*.

angle *x* = ... [2]

[Total: 2]

28 The table shows 5 different types of electromagnetic wave.

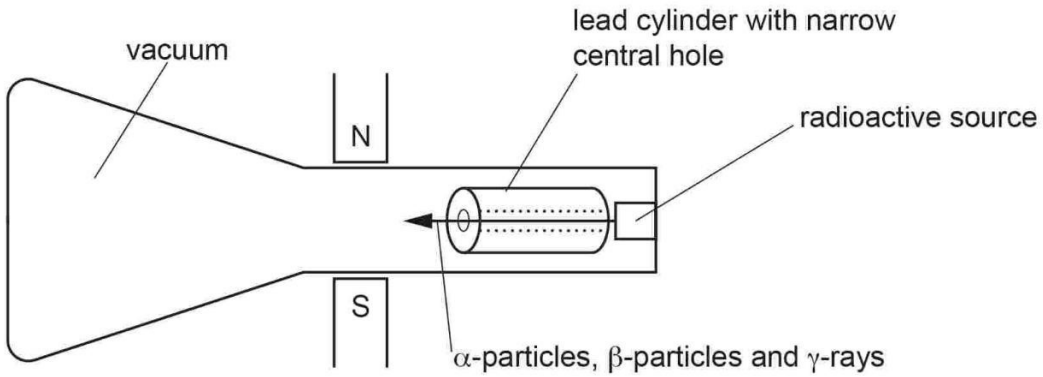
In the blank column in the table, write the numbers 1 to 5 to show the order of wavelength. Write 1 for the wave with the shortest wavelength and 5 for the wave with the longest wavelength.

type of electromagnetic wave	order of wavelength
gamma rays	
light	
microwaves	
ultraviolet	
X-rays	

[2]

[Total: 2]

29 The diagram shows a vacuum tube with a radioactive source. The radioactive source emits α-particles, β-particles and γ-rays. There is a very strong magnetic field between the N pole and the S pole of the magnet.



Describe the path of the β-particles as they pass through the magnetic field. Explain your answer.

.....

..... [2]

[Total: 2]

30 A radiation detector in a laboratory records a reading of 10 counts / min. There are no radioactive samples in the laboratory.

Carbon-14 has a half-life of 5700 years. There are atoms of carbon-14 in all living organisms.

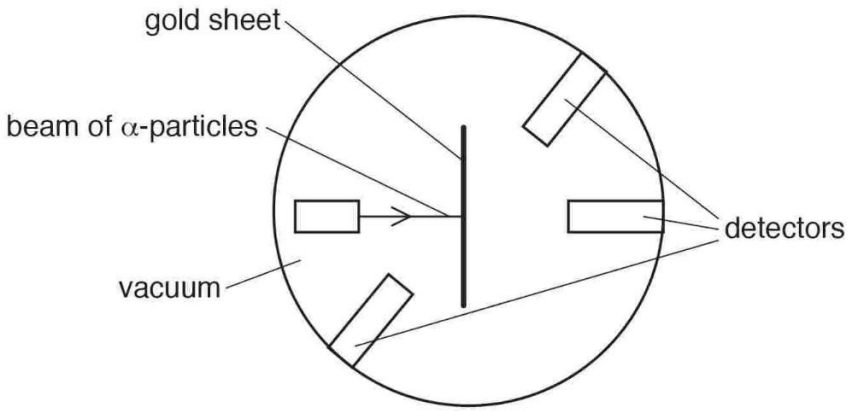
An archaeologist digs up some ancient wood. In the laboratory, a sample of this ancient wood gives a reading of 20 counts / min. An equivalent sample of living wood gives a reading of 80 counts / min. It is suggested that the age of the ancient sample is 11400 years.

Do a calculation to check whether this suggestion is correct.

[4]

[Total: 4]

31 The diagram shows a beam of α-particles moving towards a thin sheet of gold in a vacuum.



Detectors in the region surrounding the thin gold sheet detect the α-particles and determine the number of particles that travel in various directions.

State and explain what can be deduced from the following observation.

The majority of the α-particles pass through the gold sheet undeflected and are detected on the far side.

deduction .....

explanation.....

..... [2]

[Total: 2]

32 State and explain which feature of a speed–time graph shows acceleration.

.....

..... [2]

[Total: 2]

33 Calculate the force required to give a mass of 71 kg an acceleration of $6.4\,m/s^2$.

force = ... [2]

[Total: 2]

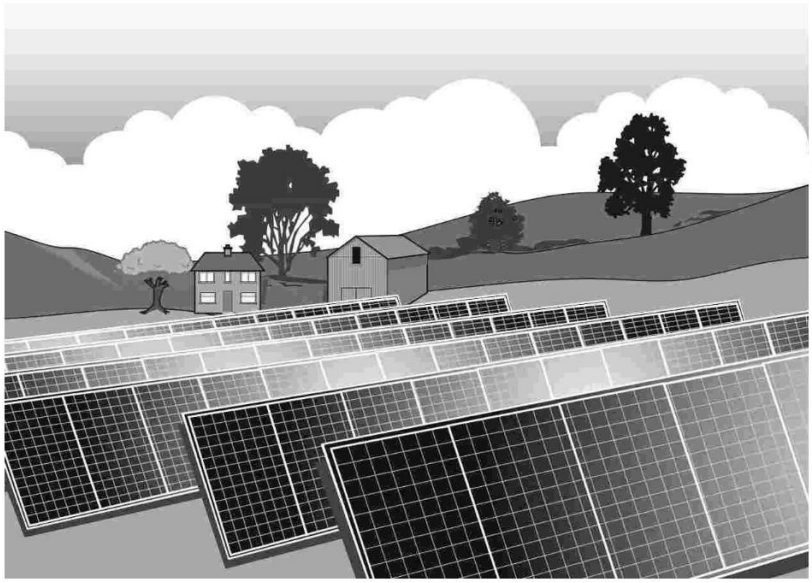
34 A radioactive nucleus of uranium-235 decays to a nucleus of thorium and emits an α-particle.
Complete the equation.

$$^{235}_{92}\mathrm{U} \longrightarrow \begin{matrix}\cdots\cdots\\ \cdots\cdots\end{matrix} \mathrm{Th} + {}^{4}_{2}\alpha$$

[2]

[Total: 2]

35 The diagram shows solar cells used to generate electrical energy.



Each group of solar cells is arranged in a rectangle 1.2 m × 2.8 m. The solar cells are situated in a region where 260 W of solar energy is received per square metre of the cells. The electrical output of each group of solar cells is a current of 2.5 A with a potential difference of 86 V.

Calculate the efficiency of the solar cells.

efficiency = ... % [4]

[Total: 4]

36 Calculate the wavelength in a vacuum of X-rays of frequency 1.3×10^{17}Hz.

wavelength = ... [3]

[Total: 3]

End of Section II

Section II	**/40**

Section III: Alternative to practical [20]

37 A student is investigating the stretching of a spring.

The apparatus is shown in Fig. 1.1.

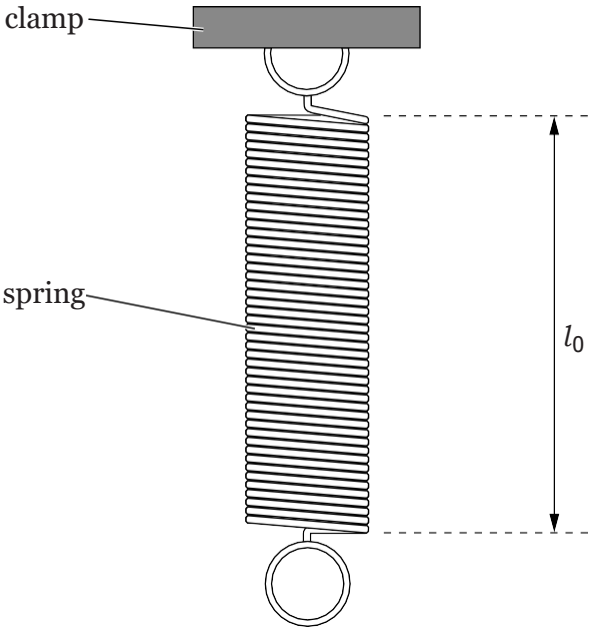


Fig. 1.1

(a) On Fig. 1.1, measure the unstretched length l_o of the spring. Record l_o in the first row of Table 1.1. [1]

(b) The student hangs a load L of 1.0N on the spring and measures the new length l of the spring. She repeats the measurements using loads of 2.0N, 3.0N, 4.0N and 5.0N. The readings are shown in Table 1.1.

(i) For each set of readings, calculate the extension e of the spring using the equation $e = (l - l_o)$. Record the values of e in the table.

Table 1.1

L/N	l/mm	e/mm
0.0		0
1.0	59	
2.0	64	
3.0	69	
4.0	74	
5.0	78	

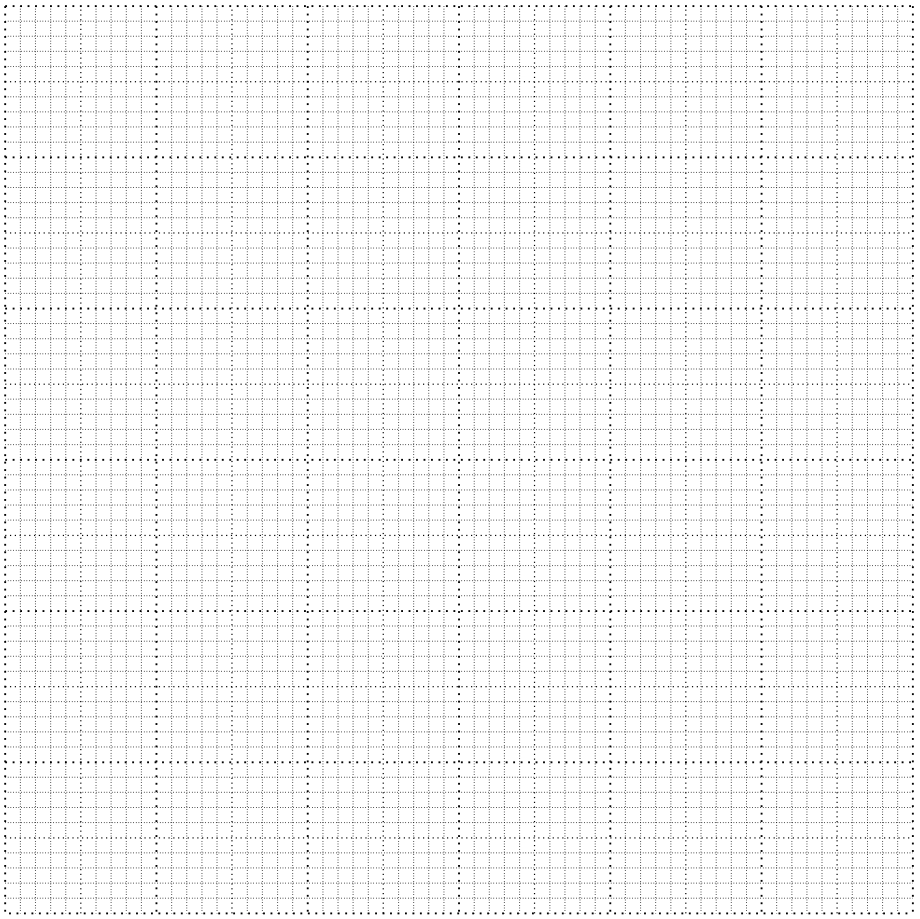
[1]

(ii) Explain briefly one precaution that you would take in order to obtain reliable readings.

.....

..... [1]

(c) Plot a graph of e/mm (y-axis) against L/N (x-axis).



[4]

d) The student removes the load from the spring and hangs an unknown load **X** on the spring. She measures the length l of the spring.

l = 72 mm

(i) Calculate the extension e of the spring.

e = ... [1]

(ii) Use the graph to determine the weight W of the load **X**. Show clearly on the graph how you obtained the necessary information.

W = ... [2]

[Total: 10]

38. A student is investigating the cooling of water.

Some of the apparatus is shown in Fig. 1.2.

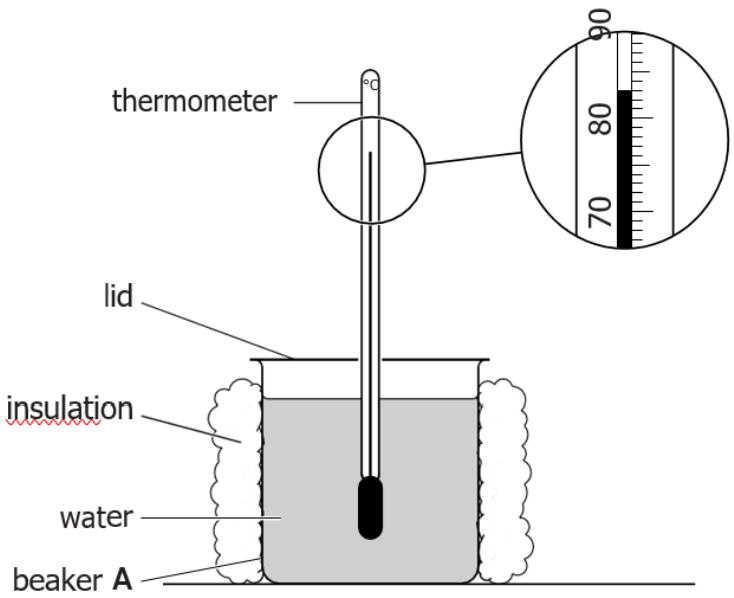


Fig. 1.2

(a) The student pours 200 cm^3 of hot water into a 250 cm^3 insulated beaker labelled **A**. He covers the top of the beaker with a lid.

The student takes a temperature reading every 30 s as the water cools. The readings are shown in Table 1.2.

(iii) Complete the column headings in the table. [1]

(iv) The starting temperature θ of the hot water in beaker **A** is shown on Fig. 1.2.

Record this temperature in the table at time t = 0 s. [1]

Table 1.2

	beaker **A** insulation and lid	beaker **B** insulation, no lid	beaker **C** lid, no insulation
t/	θ/	θ/	θ/
0		85	78
30	80	79	74
60	77	74	71
90	75	70	68
120	73	67	66
150	71	64	64

(b) The student repeats the procedure using a 250 cm^3 beaker labelled **B**. This beaker is insulated but has no lid.

He repeats the procedure again using a 250 cm^3 beaker labelled **C**. This beaker has a lid but no insulation.

All the readings are shown in Table 1.2.

(v) Tick the statement that best describes the results of the investigation.

☐ Removing the lid speeds up the rate of cooling significantly more than removing the insulation.

☐ Removing the insulation speeds up the rate of cooling significantly more than removing the lid.

☐ There is no significant difference between removing the lid and removing the insulation.

[1]

(vi) Justify your answer by reference to the readings.

.....

.....

.....[1]

(c) State two of the conditions that should be kept the same in this experiment in order for the comparison to be fair.

1. .....

.....

2. .....

.....

[2]

(d) Suggest a suitable material for the lid. Give a reason for your choice of material.

material .....

reason .....

.....

[2]

(e) Describe briefly how a measuring cylinder is read in order to obtain a reliable value for the volume of water. You may draw a diagram.

.....

.....

.....

.....[2]

[Total: 10]

End of Section III

Section III	**/20**