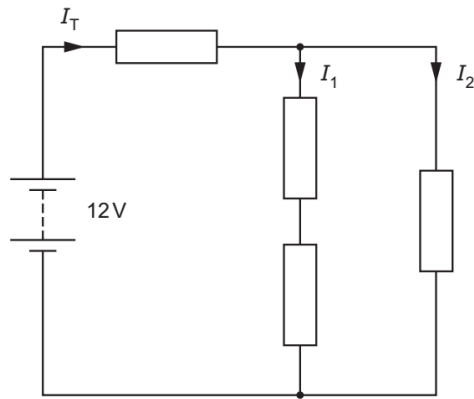


AS Level Physics B
H157/01 Foundations of physics

Question Set 3

1.

In the circuit shown, all resistors have the same resistance of $100\ \Omega$. Assume the battery has negligible internal resistance.



- (a) State the relationship between the currents I_T , I_1 and I_2 . [1]
- (b) Explain why I_2 is twice as large as I_1 . [2]
- (c) Show that the total resistance of the circuit is less than $170\ \Omega$. [2]
- (d) Calculate the power supplied by the battery.
power =W [2]

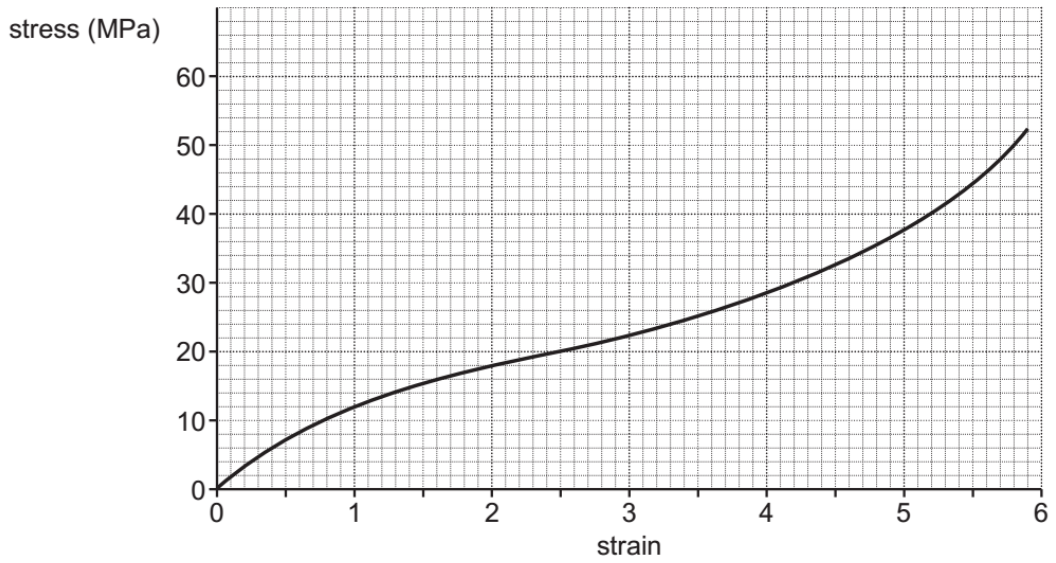
2.

The lens in a digital camera has focal length, $f = 2.0\text{ cm}$. The camera is used to take a picture of a cat that is 50 cm away.

Calculate the distance between the lens and image sensor (CCD) in the camera.
Give your answer to 2 significant figures.

image distance = m [3]

3. The graph shows the stress-strain graph for a polymer material up to fracture.



(a) Describe what the graph shows in terms of the stiffness of this polymer at different strains.

[2]

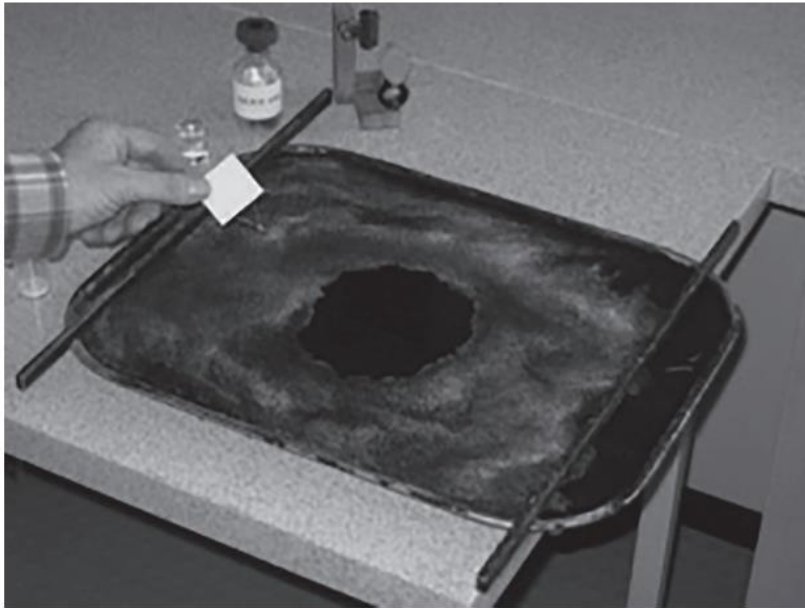
(b) Estimate the gradient of the graph just before fracture. Make your method clear.

gradient =MPa

[2]

4.

An experiment to estimate the size of an oil molecule is shown below.



A drop of oil with diameter (0.5 ± 0.1) mm is dropped into water dusted with powder.

The oil spreads out to a diameter of 20 cm in a layer that is assumed to be one molecule deep.

Estimate the size of a molecule using this data.
One mark is for stating an assumption you make in your calculation.

size of molecule = m **[3]**

5. Fig. 5.1 shows an aeroplane flying horizontally and towing a flag.

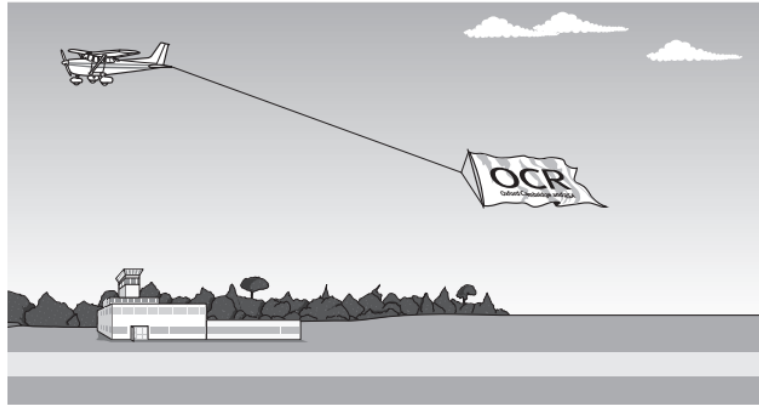


Fig. 5.1

The flag is attached to the aeroplane using a metal cable. Fig. 5.2 shows that the cable is at an angle of 20° below the line of flight of the aeroplane.

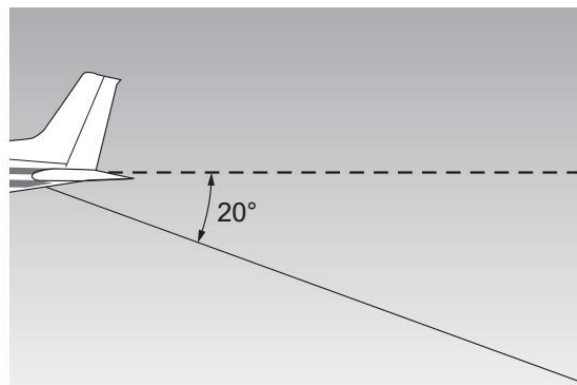


Fig. 5.2

- (a) Show that the work done in towing the flag when the aeroplane travels 1 m in the line of flight is about 1.4 kJ. [2]
- (b) Calculate the power required for towing the flag.
 power = W [1]
- (c) The diameter of the metal cable is 12 mm.
 The Young modulus of the metal cable is 210 GPa.
- (i) Calculate the operating stress in the cable during towing.
 stress = Pa [3]
- (ii) The breaking stress of the metal is 460 MPa.
 Comment on the safety of the procedure. [1]
- (iii) Calculate the strain in the cable.
 strain = [2]

6.

A student is investigating a smartphone app which records voice messages. The sound is converted into an analogue electrical signal (input p.d.) by the microphone. The signal is shown in **Fig. 6.1**.

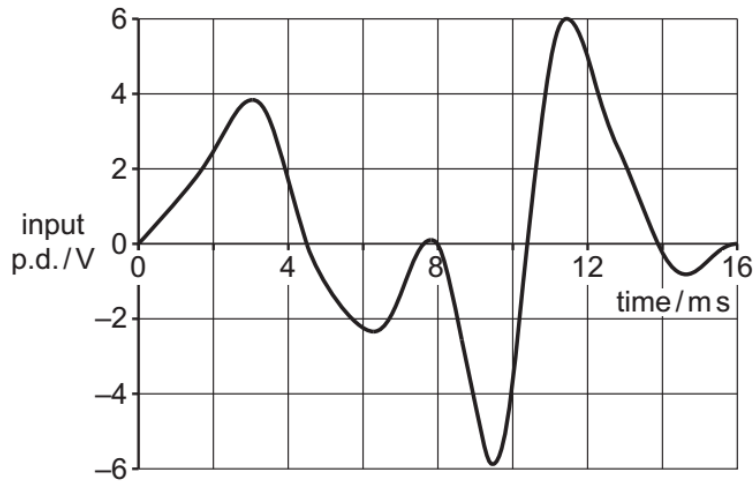


Fig. 6.1

- (a) Explain how this signal can be digitised.
You may draw on **Fig. 6.1** to support your answer.

[3]

- (b) The student records a number of messages of different lengths and records the size of the resulting (uncompressed) sound files. Her results are tabulated below.

Message Time/s	File Size/ 10^3 bytes
1	29
2	40
5	88
10	162
20	317

Fig. 6.2 shows a graph of the file size plotted against message time for the first three data points.

- (i) Complete the graph and draw the best fit line.

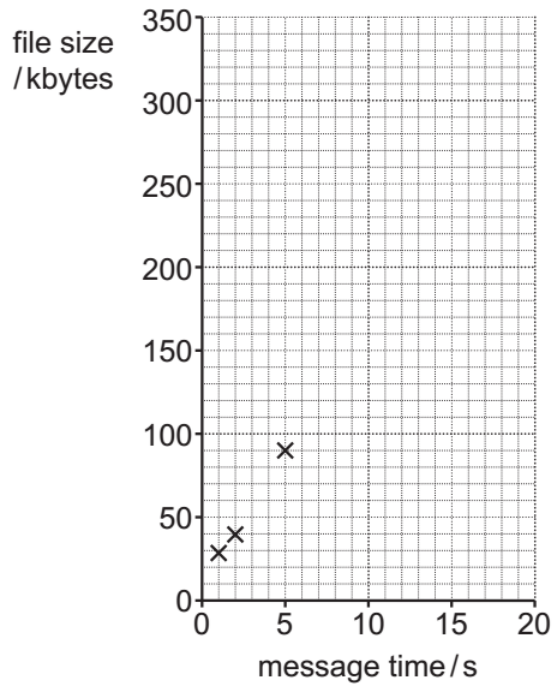


Fig 6.2

[2]

- (ii) State how the graph shows that there is a fixed amount of information transmitted with each file that is independent of the message time.

[1]

- (iii) Use the data to estimate the number of **bits** stored in the file per second of sound recorded.

bits per second = [2]

Total Marks for Question Set 3: 34



Oxford Cambridge and RSA

Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact The OCR Copyright Team, The Triangle Building, Shaftesbury Road, Cambridge CB2 8EA. OCR is part of the Cambridge Assessment Group; Cambridge