Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	P	H	0	2	/	1	Signature	

Paper Reference(s)

6PH02/1

Edexcel GCE

Physics

Advanced Subsidiary

Unit 2: Physics at Work

Sample Assessment Material

Time: 1 hour 20 minutes

Materials required for examination
Nil

Items included with question papers
Nil

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
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22	
Total	

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature.
Check that you have the correct question paper.
Answer ALL the questions. Write your answers in the spaces provided in this question paper.
Some questions must be answered with a cross in a box (☒). If you change your mind, put a line through the box (☒) and put a cross in another box (☒).

Information for Candidates

The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 22 questions in this question paper. The total mark for this paper is 80.
There are 20 pages in this question paper. Any blank pages are indicated.

Advice to Candidates

Quality of written communication will be taken into account in the marking of your responses to Questions 15, 19 and 21. These questions are indicated with an asterisk. Quality of written communication includes clarity of expression, the structure and presentation of ideas and grammar, punctuation and spelling.

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Answer ALL the questions.

For questions 1–9, select one answer from A to D and put a cross in the box (☒). If you change your mind, put a line through the box (☒) and then mark your new answer with a cross (☒).

1. Three identical resistors are connected across a potential difference V so that one of them is in parallel with the other two which are connected in series. The power dissipated through the first one, compared to the power dissipated by each of the other two, is approximately

☒ **A** the same

☒ **B** half as much

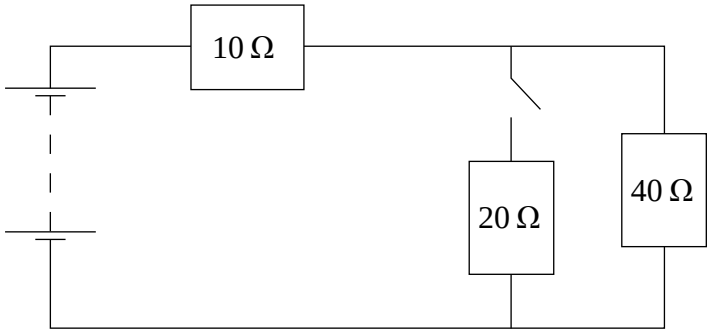
☒ **C** twice as much

☒ **D** four times as much

Q1

(Total 1 mark)

2. A circuit is set up as shown in the diagram.



When the switch is closed, the potential difference across the 20 Ω resistor would

☒ **A** equal the potential difference across the 10 Ω resistor

☒ **B** be twice the potential difference across the 10 Ω resistor

☒ **C** equal the potential difference across the 40 Ω resistor

☒ **D** be half the potential difference across the 40 Ω resistor

Q2

(Total 1 mark)

Leave blank

3. How much electrical energy is required to move 4.00 mC of charge through a potential difference of 36.0 V?

☒ **A** 1.11 × 10-4 J

☒ **B** 0.144 J

☒ **C** 144 J

☒ **D** 9000 J

Q3

(Total 1 mark)

4. A source of light emits a train of waves lasting 0.04 μs. The light has a wavelength of 600 nm and the speed of light is 3 × 108 m s-1. How many complete waves are sent out?

☒ **A** 2.0×10^{7}

☒ **B** 4.5×10^{7}

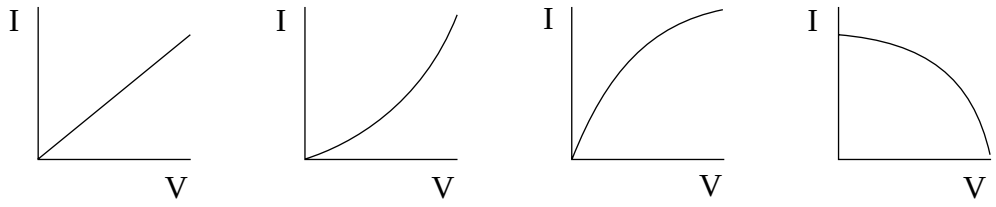
☒ **C** 2.0×10^{10}

☒ **D** 4.5×10^{13}

Q4

(Total 1 mark)

5. Which of the following graphs gives the current-potential difference characteristic of an NTC thermistor?



☒ **A** ☒ **B** ☒ **C** ☒ **D**

Q5

(Total 1 mark)

Leave blank

6. Which of the following statements about standing waves is true?

☒ **A** particles between adjacent nodes all have the same amplitude.

☒ **B** particles undergo no disturbance at an antinode.

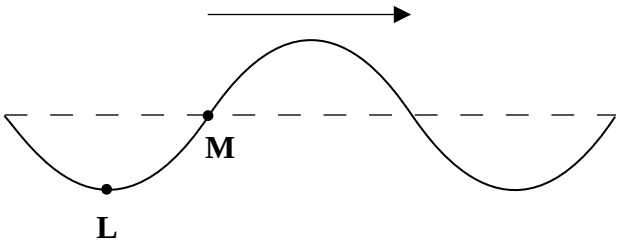
☒ **C** particles immediately either side of a node are moving in opposite directions.

☒ **D** particles between adjacent nodes are out of phase with each other.

Q6

(Total 1 mark)

7. The diagram shows a wave on a rope. The wave is travelling from left to right.



At the instant shown, point **L** is at a maximum displacement and point **M** has zero displacement. Which row in the table correctly describes the motion of points **L** and **M** during the next half cycle of the wave?

		Point L	Point M
☒	**A**	rises	falls
☒	**B**	rises	falls then rises
☒	**C**	rises then falls	rises
☒	**D**	rises then falls	falls then rises

Q7

(Total 1 mark)

Leave blank

8. Electromagnetic waves are produced by oscillating charges. Sound waves are produced by oscillating tuning forks. How are these waves similar?

- ☒ **A** they are both longitudinal waves.
- ☒ **B** they are both transverse waves.
- ☒ **C** they both have the same frequency as their respective sources.
- ☒ **D** they both require a medium to travel through.

Q8

(Total 1 mark)

9. Two points on a progressive wave differ in phase by $\frac{\pi}{4}$ radian. The distance between them is 0.50 m. The frequency of the oscillations is 10 Hz. The maximum speed of the wave is

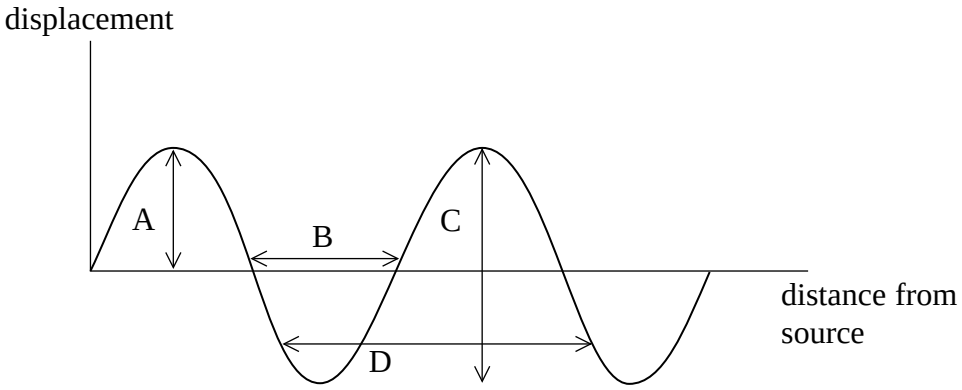
- ☒ **A** 2.50 m s^{-1}
- ☒ **B** 5.00 m s^{-1}
- ☒ **C** 12.5 m s^{-1}
- ☒ **D** 40.0 m s^{-1}

Q9

(Total 1 mark)

Leave blank

10. A loudspeaker emits a sound wave of wavelength 0.66 m. The diagram shows how displacement varies with distance from the loudspeaker at one instant of time.



(a) Which letter indicates the wavelength of the sound wave?

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(1)

(b) Sound travels at 330 m s^{-1} in air. Calculate the period of the wave.

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Period = ...

(3)

Q10

(Total 4 marks)

11. State **two** conditions necessary for total internal reflection to occur at an interface between air and water.

Condition 1 .....

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Condition 2 .....

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Q11

(Total 2 marks)

Leave blank

12. (a) Explain with the aid of diagrams why transverse waves can be polarised but longitudinal ones cannot be polarised.

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(3)

(b) Describe with the aid of a diagram how you could demonstrate that light can be polarised.

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(3) **Q12**

(Total 6 marks)

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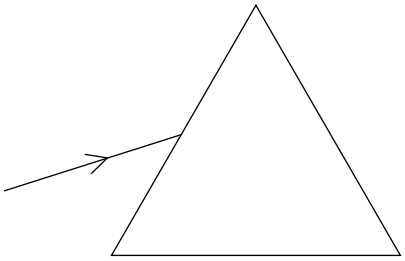
13. A ray of light travelling in air, strikes the middle of one face of an equilateral glass prism as shown.



State what happens to the following properties as the light goes from the air into the glass.

Frequency.....

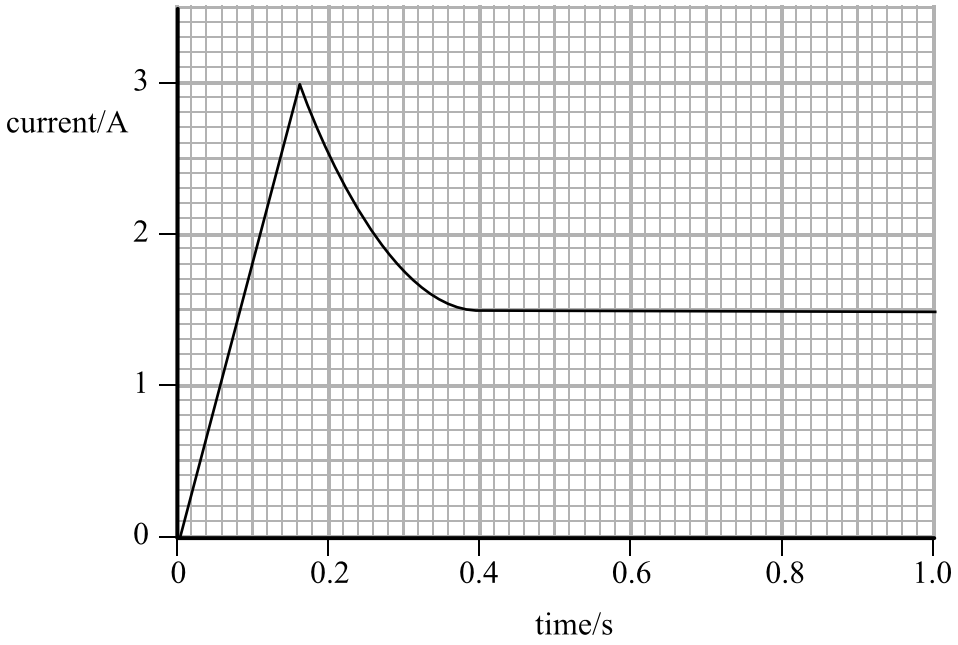
Wavelength .....

Speed..... **Q13**

(Total 3 marks)

Leave blank

14. The graph shows how the current in a 9 V filament lamp varies during one second after it has been turned on.



(a) A student wishes to carry out an experiment to verify these results. Explain why using a sensor and computer is a sensible option and suggest a suitable sampling rate.

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(2)

(b) Explain the shape of the graph and why the filament is more likely to fail when being switched on rather than at other times.

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(4)

Q14

(Total 6 marks)

Leave blank

***15.** About 100 years ago X-rays were first used in hospitals. At that time, many of the doctors who worked with X-rays died young. Explain why this occurred and the implications it has for the use of new technology today.

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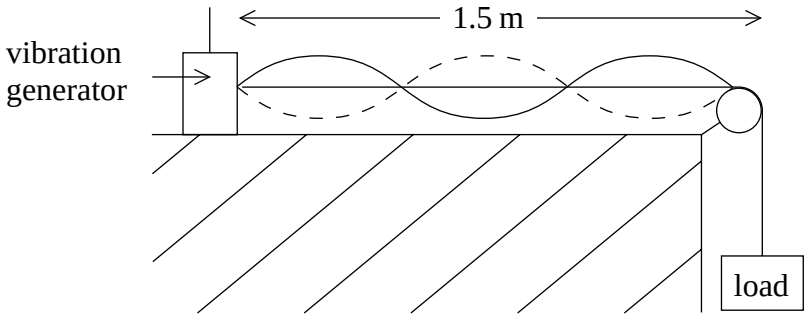
Q15

(Total 4 marks)

16. The following apparatus is set up. When the frequency of the vibrator is 60 Hz, the standing wave shown in the diagram is produced.



(a) What is the wavelength of this standing wave?

Wavelength = ...

(1)

(b) The frequency of the vibrator is altered until the standing wave has two more nodes. Calculate the new frequency.

Frequency =.....

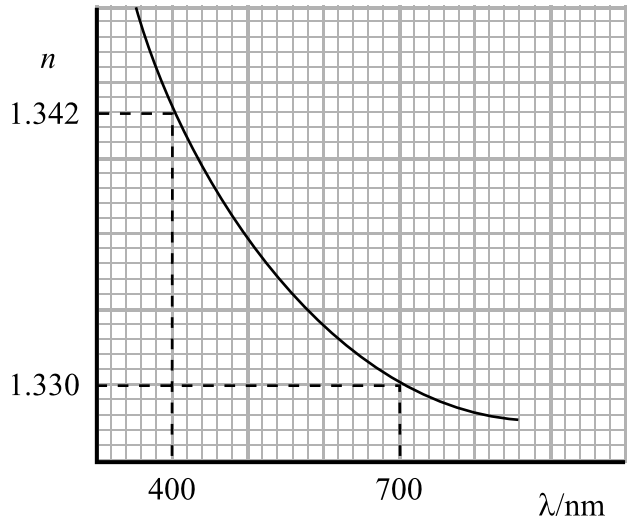
(2)

Q16

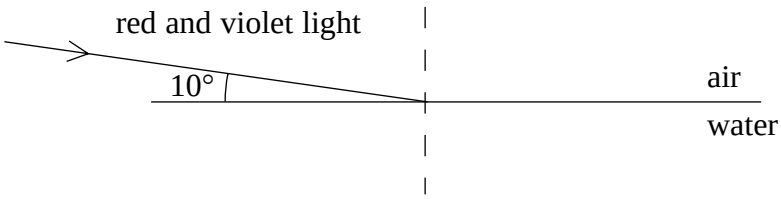
(Total 3 marks)

Leave blank

17. The graph shows how the refractive index of water, *n* varies with wavelength λ of the light in a vacuum. The values for red and violet light are indicated.



The diagram shows a mixture of red and violet light incident on an air/water interface.



Calculate the angle of refraction for the red light.

Angle of refraction = ...

(3)

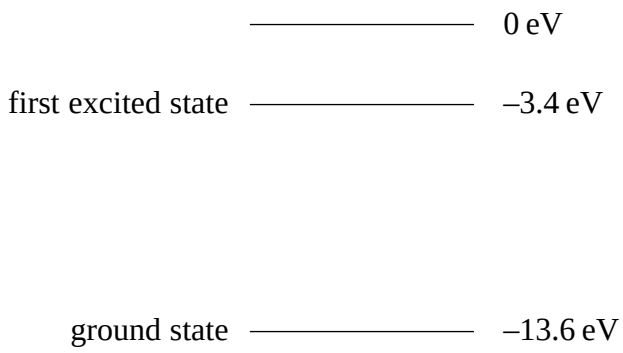
On the diagram draw the approximate paths of the refracted rays.

(2) **Q17**

(Total 5 marks)

Leave blank

18. Below is a simplified energy level diagram for atomic hydrogen.



(a) A free electron with 12 eV of kinetic energy collides with an atom of hydrogen. As a result the atom is raised to its first excited state. Calculate the kinetic energy of the free electron, in eV, after the collision.

Kinetic energy =..... eV

(2)

(b) Calculate the wavelength of the photon emitted when the atom returns to its ground state.

Wavelength =.....

(3)

Q18

(Total 5 marks)

Leave blank

*19. A group of students is discussing why the resistance of the metal filament of a lamp and the resistance of an NTC thermistor respond differently to changes in temperature.

One student says that the increased vibrations of the atoms affect the conduction process. Another student says that as the temperature increases more electrons can break free of the atoms and take part in conduction.

Both students are correct. Explain how these **two** effects apply to the lamp and the thermistor.

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Q19

(Total 5 marks)

Leave blank

20. Until the early 20th century, the wave theory of light was successful at explaining different properties of light such as reflection, refraction and diffraction. With the discovery of the photoelectric effect, scientists had a problem. The wave theory of light assumes that the energy of the wave is spread over the whole wavefront. Using the wave theory, scientists calculated that, if light of very low intensity is shone onto the metal, it should take a very long time for an electron to gain sufficient energy to break free from a metal. It was discovered that, providing the light was above a certain frequency, electrons could escape from a metal surface instantly. The new model that was introduced treated light as being made of particles called photons.

(a) What is meant by diffraction?

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(2)

(b) How did considering light as photons enable scientists to explain why electrons could be emitted instantly from a metal surface?

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(2)

(c) Explain why this effect only happens when the light is above a certain frequency.

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(2) **Q20**

(Total 6 marks)

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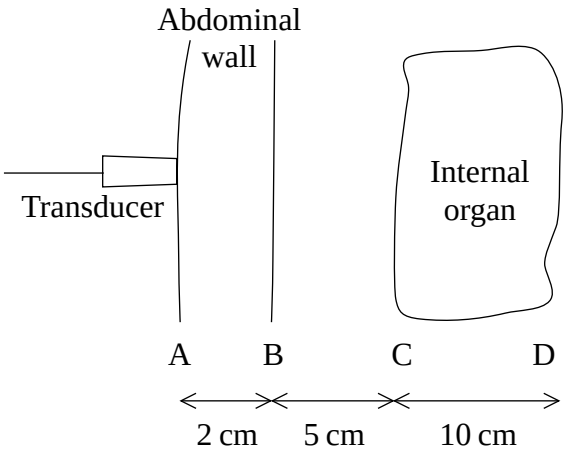
***21.** (a) Ultrasound images of the body are a useful diagnostic tool for doctors. A single transducer can be used both to send and receive pulses of ultrasound.

The diagram shows a lateral cross-section through part of the abdomen. The diagram is not to scale.



(i) Calculate the time interval between sending out a single pulse and receiving its echo from interface B. The speed of ultrasound in the abdominal wall is 1500 m s^{-1}.

Time interval = ...

(3)

(ii) The time between pulses being emitted by the transducer is 200 μs. At what frequency are the pulses emitted?

Frequency = ...

(2)

Leave blank

(iii) The time interval before the echo returns from interface D is 250 μs. Suggest why this time interval will make reflections from D difficult to interpret and what could be done to overcome this problem.

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(3)

(iv) State **one** reason why ultrasound rather than X-rays is now used to scan expectant mothers.

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(1)

(b) Ultrasound is also used to measure blood flow in the body. It uses the Doppler shift of the reflected pulse to measure the speed of blood through the arteries of the body.

Describe the principle of this method and how it can be used to determine the speed of blood.

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(4)

Q21

(Total 13 marks)

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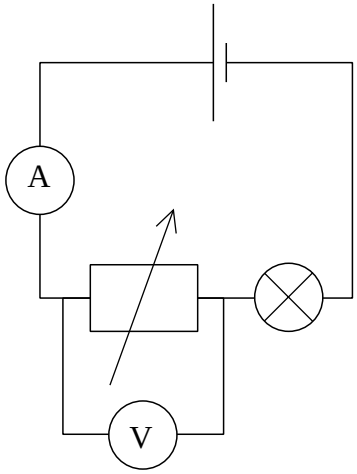
22. A student sets up the following circuit to measure the internal resistance of a cell.



(a) What is wrong with his circuit diagram?

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(1)

(b) Using the correct circuit the student obtains the following results.

Current in the cell *I*/A	**Terminal potential difference across the cell *V*/V**
0.5	1.2
0.9	1.0
1.5	0.8
1.9	0.6
2.5	0.4
2.9	0.2

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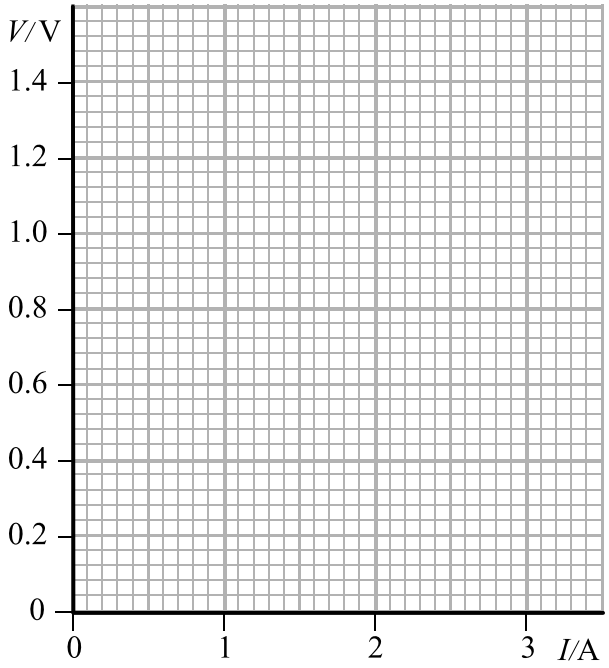
(i) On the grid below, plot these results and draw the line of best fit through your points.



(3)

(ii) Use your graph to determine the e.m.f. of the cell.

e.m.f. = ...

(1)

(iii) Use your graph to determine the internal resistance of the cell.

Internal resistance = ...

(2)

(c) The experiment is repeated with two such cells connected in series. How does the graph differ?

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(2) **Q22**

(Total 9 marks)

TOTAL FOR PAPER: 80 MARKS

END