NA

GAN ENG SENG SCHOOL
Preliminary Examination 2022

CANDIDATE NAME			
CLASS		**INDEX NUMBER**	

SCIENCE (PHYSICS) 5105/01
Paper 1 Multiple Choice

19 Aug 2022
Papers 1 & 2: 1 hour 15 minutes

Sec 4 Normal (Academic)

Additional Materials: OTAS

Calculators are allowed in the examination

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, class and index number on the OTAS.

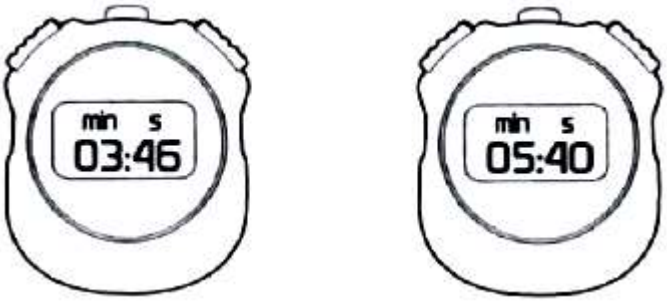
There are **twenty** questions in this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C**, and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate OTAS.

Read the instructions on the OTAS very carefully.

Answers to Paper 1 and 2 must be handed in separately.
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
You are advised to spend no more than **30 minutes** on **Paper 1**.
You may proceed to answer Paper 2 as soon as you have completed Paper 1.
Any rough working should be done in this booklet.
The use of an approved scientific calculator is expected, where appropriate.

Total Marks
20

1 A stopwatch is used to measure the time taken for 50 oscillations of a pendulum. The diagrams show the stopwatch at the start and at the end of the 50 oscillations.

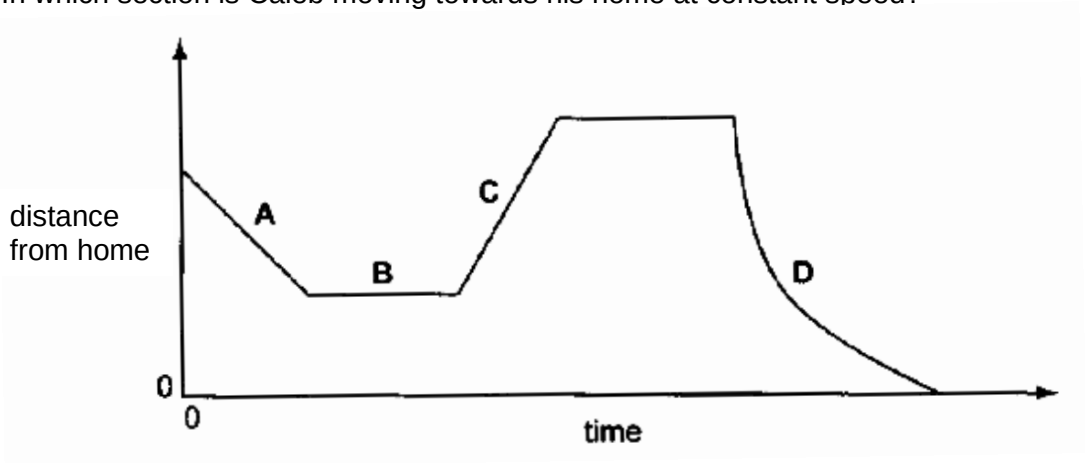


What is the period of the pendulum?

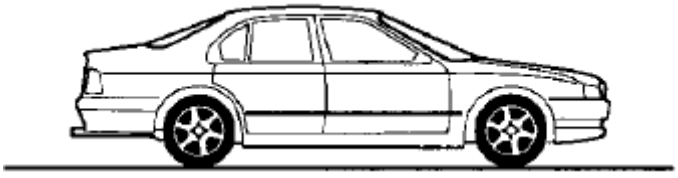
A 2.28 s **B** 3.88 s **C** 4.52 s **D** 6.80 s

2 The distance-time graph shows Caleb moving near his home while doing the GESS half-marathon challenge.

In which section is Caleb moving towards his home at constant speed?



3 Horizontal forces can act on a moving car.



In which situation are the forces balanced?

A The car accelerates in a straight line.

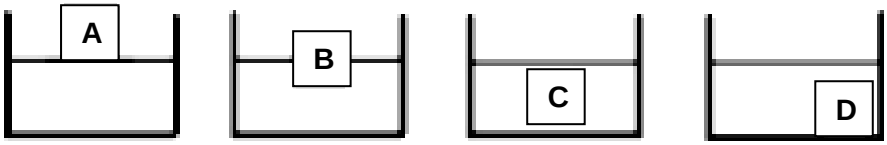
B The car changes direction at constant speed.

C The car slows down and finally stops.

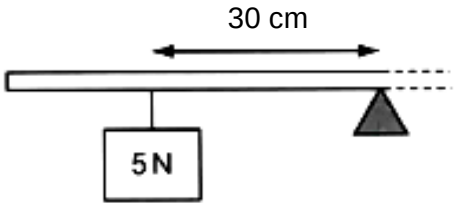
D The car travels at constant speed in a straight line.

4 The diagram shows four cubes **A**, **B**, **C** and **D** placed in a beaker of an unknown liquid.

Which cube has the same density as the unknown liquid?

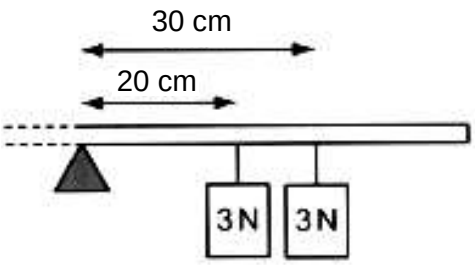


5 A uniform beam is pivoted at its centre of gravity and balanced by suspending a 5 N weight from one side and two 3 N weights from the other side. The diagram shows the left-hand side of the beam.

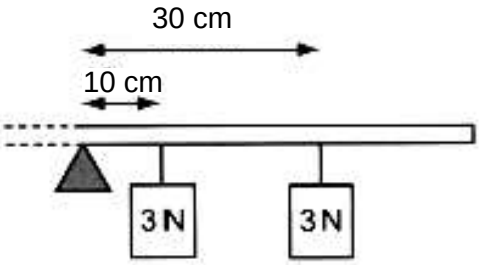


Which diagram shows the right-hand side of the beam when the beam is balanced?

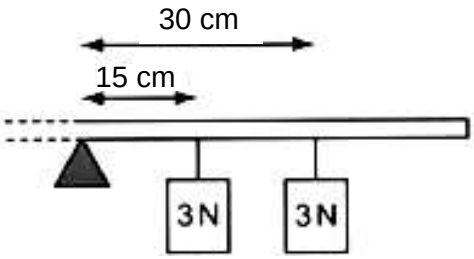
A



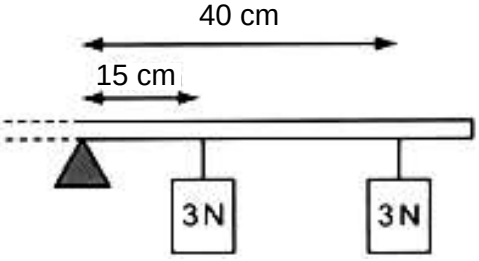
B



C



D



6 Which surface will allow a knife to cut meat more easily, and what is the corresponding reason?

	surface	reason
A	wide	greater pressure on the meat
B	wide	less pressure on the meat
C	narrow	greater pressure on the meat
D	narrow	less pressure on the meat

7 Hazel drops a pebble of mass 0.1 kg from a height of 8 m. The gravitational potential energy (E_p) and kinetic energy (E_k) of the pebble vary at different heights. Some heights and energy values are shown in the table.

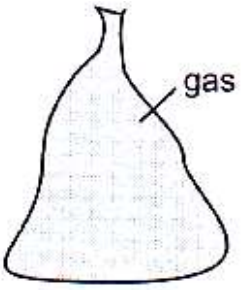
height of pebble above Ecopond / m	E_k / J	E_p / J	total energy / J
0.0	8	0	8
2.0	2	6	8
4.0	–	–	8
6.0	6	2	8
8.0	0	8	8

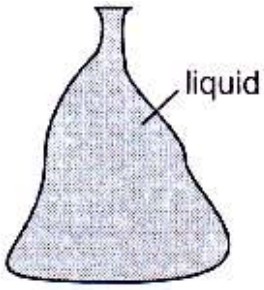
Which statement is correct for the 4.0 m reading?

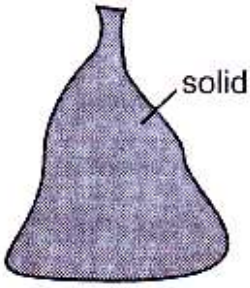
A $E_k > E_p$ **B** $E_k < E_p$

C $E_k = E_p$ **D** $E_k - E_p = 8$

8 Xing Hui has three sealed plastic bags. One bag is full of gas, one of liquid and one of solid. She squeezes each bag to see if it changes shape, and warms each bag to see if it expands.







Which bag contains gas?

A The one that changes shape easily and expands the least when heated.

B The one that changes shape easily and expands.

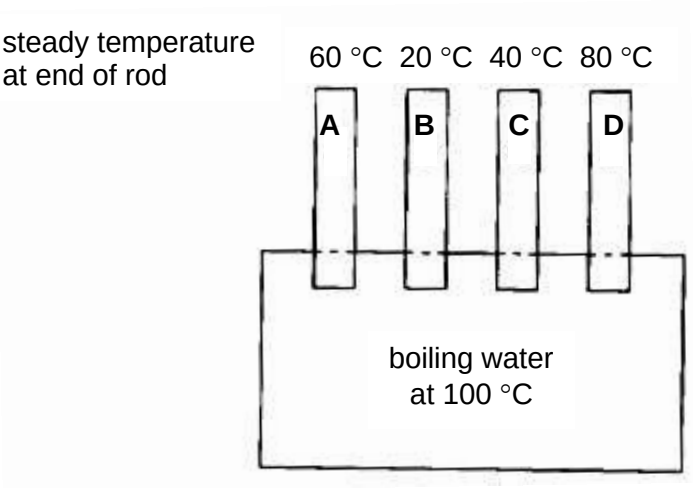
C The one that is fixed in shape and expands the least when heated.

D The one that is fixed in shape and expands the most when heated.

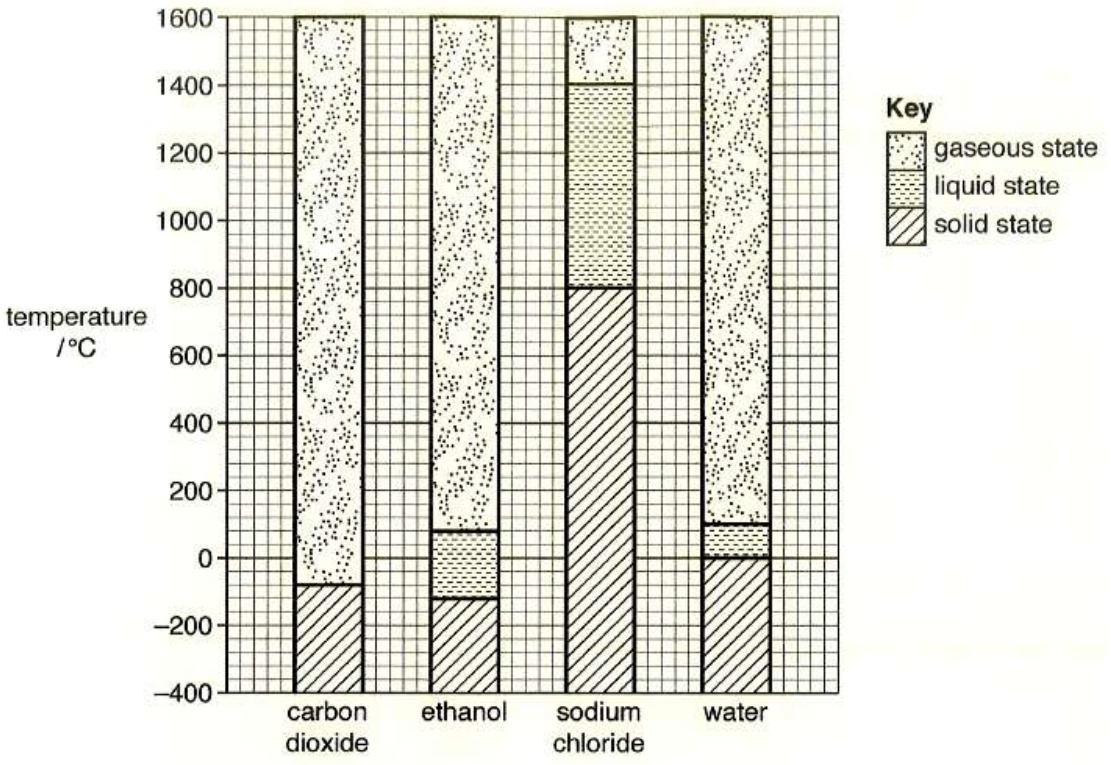
9 The diagram shows four rods (**A**, **B**, **C** and **D**) each made of a different metal. One end of each rod is in contact with boiling water and the other reaches the steady temperature shown. The table shows the resistivities of these four rods (not in order).

Which rod shows the correct resistivity according to the steady temperature?

	resistivity / Ω m
A	9.8×10^{-8}
B	5.3×10^{-8}
C	2.8×10^{-8}
D	1.5×10^{-8}



10 The bar graph shows the temperature at which some substances change state.

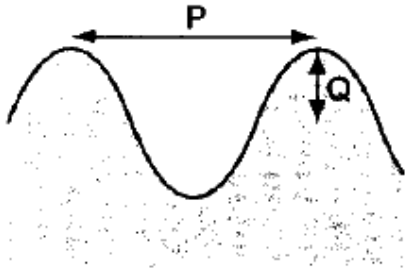


Which substance freezes at 800 °C?

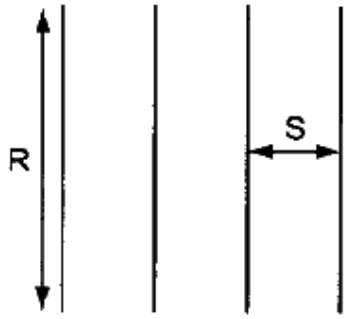
A carbon dioxide **B** ethanol

C sodium chloride **D** water

11 The diagrams show different views of a water wave in a ripple tank.



cross-section of wave

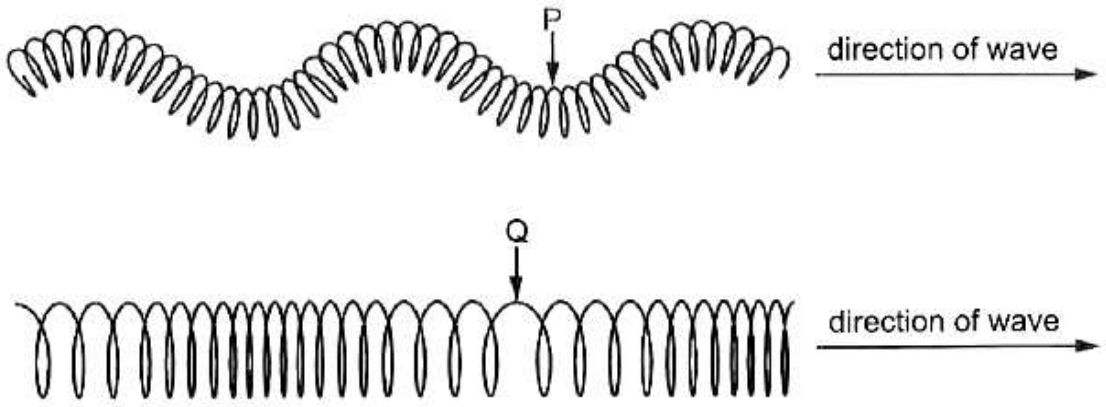


crests seen from above

Which letters represent an amplitude and a wavelength?

	Amplitude	wavelength
A	S	P
B	Q	S
C	S	R
D	Q	R

12 A spring can be used to show a longitudinal wave and a transverse wave.



Which row represents the motion of the spring and type of wave for P and Q?

	motion of particles at		type of wave for	
	P	Q	P	Q
A	↕	↔	transverse	longitudinal
B	↔	↕	transverse	longitudinal
C	↕	↔	longitudinal	transverse
D	↔	↕	longitudinal	transverse

13 The diagram represents the electromagnetic spectrum.

gamma rays	*X*	ultraviolet	light	infrared	*Y*	radio waves

Which row correctly shows the application of waves *X* and *Y*?

	X	*Y*
A	checking welds	intruder alarm
B	checking welds	satellite communication
C	sunbeds	intruder alarm
D	sunbeds	satellite communication

14 Statements about the common properties of all electromagnetic waves are shown.

(I) They transfer energy from one place to another.

(II) They are longitudinal waves.

(III) They can travel through vacuum.

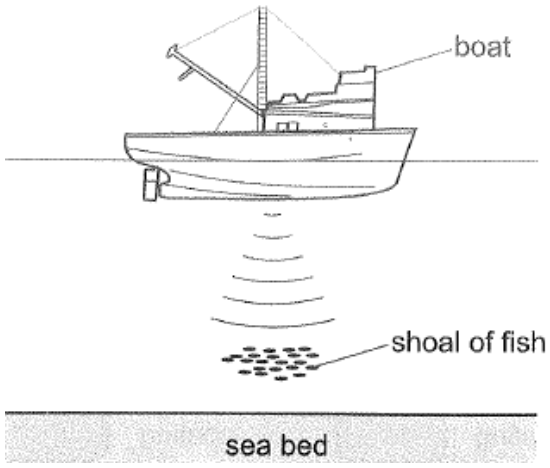
(IV) They travel through vacuum at the speed of 330 m/s.

(V) They all show wave properties like reflection and refraction.

How many of these statements are incorrect?

A 1 **B** 2 **C** 3 **D** 4

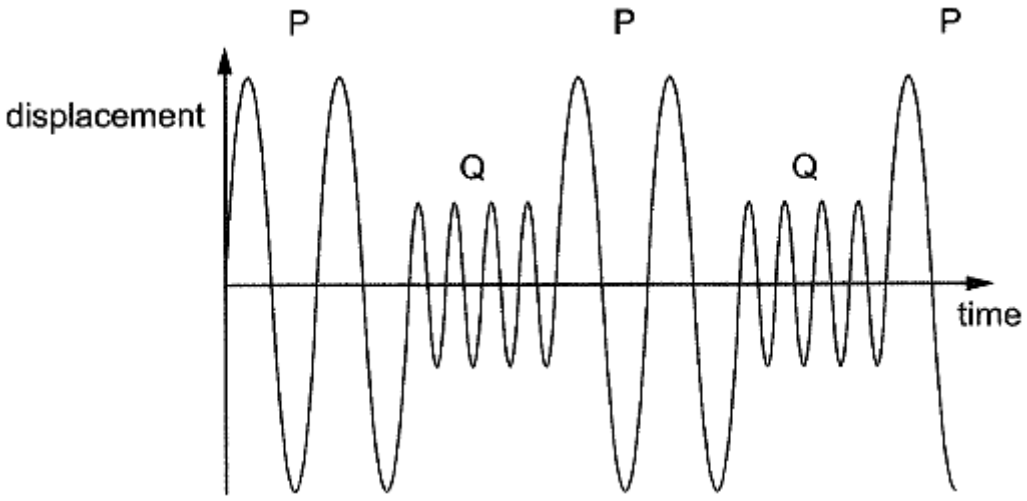
15 A fishing boat sends out a pulse of sound waves towards the sea bed and picks up two echoes, a faint one followed by a strong one. The echoes are heard 0.5 s and 0.7 s after the pulse is emitted. The velocity of sound in seawater is 1 500 m/s.



How far below the boat is the shoal of fish?

A 375 m **B** 525 m **C** 750 m **D** 1 050 m

16 An ambulance siren emits two different sounds P and Q. These are produced alternately. The diagram represents the sounds emitted.



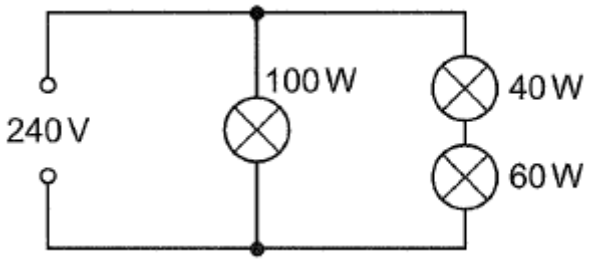
Which sound is softer and which has a higher pitch?

	softer	higher pitch
A	P	P
B	P	Q
C	Q	P
D	Q	Q

17 When a current of 0.54 A flows through a lamp for 1 minute, 97.2 J of electrical energy is converted to light energy. What is the potential difference across the lamp?

A 0.87 V **B** 3.0 V **C** 32 V **D** 52 V

18 Three 240 V lamps, of different power ratings are connected as shown.



What is the effective resistance of the circuit?

A 50 Ω **B** 208 Ω **C** 288 Ω **D** 465 Ω

19 The electric tariff is 32.28 cents per kWh from 1 July to 30 September 2022 in Singapore. How much does it cost if Emmanuel uses the 240 V, 1 kW air-conditioner for 6 hours every night in the month of July so that he can sleep well?

A $14.41 **B** $58.10 **C** $60.04 **D** $250.17

20 Which electrical appliance is either not safe to use or is unable to work?

A 2-pin plug hair dryer with double insulation

B 240 V, 200 W toaster with 3 A fuse

C 3-pin plug electric iron with no double insulation

D 240 V, 1 kW air-conditioner with 3 A fuse

END OF PAPER

GESS Preliminary Exam 2021 Science (Physics) 5105/01

Question	Answer	Explanation
1	**A**	Time taken for 50 oscillations = 5 min 40 s – 3 min 46 s = 1 min 54 s Period of pendulum = time taken for 1 oscillation = [(1 × 60) + 54] / 50 = **2.28 s**
2	**A**	Gradient of distance-time graph = speed Both sections A and C have constant gradient (i.e. constant speed). As Caleb is moving towards his home, the distance from home should be decreasing. Hence Section A shows Caleb is moving towards his home at constant speed.
3	**D**	When the forces are balanced, there is no resultant force and thus no acceleration. Since the car is already moving, it will continue to move at constant velocity.
4	**C**	When an object is placed in a liquid having the same density as the object, it hangs suspended in the liquid.
5	**A**	Anticlockwise moment due to 5 N weight = 5 N × 0.3 m = 1.5 Nm When the beam is balanced, the sum of anticlockwise moments about a pivot is equal to the sum of clockwise moments about the same pivot. **A** produces clockwise moment (3 N × 0.2 m) + (3 N × 0.3 m) = **1.5 Nm** **B** produces clockwise moment (3 N × 0.1 m) + (3 N × 0.3 m) = 1.2 Nm **C** produces clockwise moment (3 N × 0.15 m) + (3 N × 0.3 m) = 1.35 Nm **D** produces clockwise moment (3 N × 0.15 m) + (3 N × 0.4 m) = 1.65 Nm
6	**C**	To cut the meat easier, a knife should a narrow surface (smaller surface area) so that it exerts a greater pressure on the meat and less force can be used.
7	**C**	The principle of conservation of energy states that energy cannot be created or destroyed but convert from one form to another and the total energy remains the same. $E_p = mgh = 0.1 \times 10 \times 8.0 = 8$ J At a height of 4.0 m, $E_p = 0.1 \times 10 \times 4.0 = 4$ J Since total energy is 8 J, $E_k = 8 - 4 = 4$ J and $E_k = E_p$.
8	**B**	Gas has no fixed shape and no fixed volume and is easily compressible. It expands the most when heat as gas particles take up whatever space available.
9	**D**	Rod **D** is the best conductor of heat and thus able to reach the highest steady temperature among the four metal rods. It has the most delocalized electrons and the smallest resistivity.
10	**C**	The line between solid state and liquid state shows the melting point (or freezing point). Only sodium chloride is in solid state and liquid state at 800 °C.

Question	Answer	Explanation
11	**B**	P and S represent a wavelength. Q represents an amplitude. R represents a wavefront.
12	**A**	A transverse wave is a wave where the direction of vibration is perpendicular to the direction of wave motion. A longitudinal wave is a wave where the direction of vibration is parallel to the direction of wave motion. P is a transverse wave while Q is a longitudinal wave.
13	**B**	*X* is X-rays and *Y* is microwaves. Checking welds is an application of X-rays. Intruder alarm is an application of infrared. Sunbeds is an application of ultraviolet. Satellite communication is an application of microwaves.
14	**B**	Statements (II) and (IV) are incorrect. All electromagnetic waves are transverse waves and they travel through vacuum at the speed of light (3×10^8 m/s).
15	**A**	The echo (reflected sound) from the shoal of fish and the seabed are heard 0.5 s and 0.7 s respectively after the pulse is emitted from the boat. Distance between the shoal of fish and the boat = 1 500 × (0.5 / 2) = **<u>375 m</u>**
16	**D**	P is louder and has a lower pitch than Q as P has a larger amplitude and lower frequency (fewer waves within the same timing) than Q.
17	**B**	$Q = It$ = 0.54 A × (1 × 60 s) = 32.4 C $V = W / Q$ = 97.2 J / 32.4 C = **<u>3.0 V</u>**
18	**D**	$P = VI = I^2R = V^2 / R$ Resistance of 100 W lamp = 240^2 / 100 = 576 Ω Resistance of 60 W lamp = 240^2 / 60 = 960 Ω Resistance of 40 W lamp = 240^2 / 40 = 1 440 Ω The 60 W lamp and the 40 W lamp are in series with each other and both of them are in parallel to the 100 W lamp. Effective resistance of the circuit = $\{ (1/576) + [1 / (960 + 1\,440)] \}^{-1}$ = **<u>465 Ω</u>**
19	**C**	Cost = {[(1 kW × 6 h) × 31] × 32.28} / 100 = **<u>$60.04</u>**
20	**D**	Current used by air-conditioner = $(1 \times 10^3) / 240$ = 4.17 A A 3 A fuse in 240 V, 1 kW air-conditioner will blow and the air-conditioner cannot work. Current used by toaster = 200 / 240 = 0.833 A A 3 A fuse in 240 V, 200 W toaster is suitable as the fuse rating is not too high. A 2-pin plug hairdryer with double insulation does not need an earth wire as its external casing is not made of metal. A 3-pin plug electric iron is safe to use and does not need double insulation as the earth wire will direct any current in the metal casing to the ground.