CHUNG CHENG HIGH SCHOOL (YISHUN)

NA

2022 Preliminary Examination
Secondary Four Normal (Academic)

CANDIDATE NAME			
CLASS		INDEX NUMBER	

SCIENCE (PHYSICS) 5105/02

27 July 2022

Paper 2 Physics **Paper 1 and 2: 1 hour 15 minutes**

Candidates answer on the Question Paper
Additional Materials: NIL

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number in the spaces at the top of this page.
Write in dark blue or black pen.
You are to use a soft pencil for any diagrams or graphs.
Do not use paper clips, highlighters, glue, correction fluid.

Answer **all** questions in Section A and any **two** questions in Section B.
The use of an approved scientific calculator is expected, where appropriate.
In calculations, you should show all the steps in your working, giving your answer at each stage.
You are advised to spend no longer than 30 minutes on Paper 1.
You may proceed to answer Paper 2 as soon as you have completed Paper 1.

At the end of the examination, hand in your answers to Paper 1 and Paper 2 separately.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
Section A	
Section B	
Total	

Setter: Mr Thong Nai Kee

Section A (14 marks)
Answer **ALL** questions in this section in the spaces provided.

1 In many countries, people use solar heating to provide hot water for their homes. **Fig. 1.1** shows a typical solar heating system. Water is pumped through copper pipes to the roof where they are exposed to the sun. The hot water is then pumped into a storage tank where it heats up water for the home.

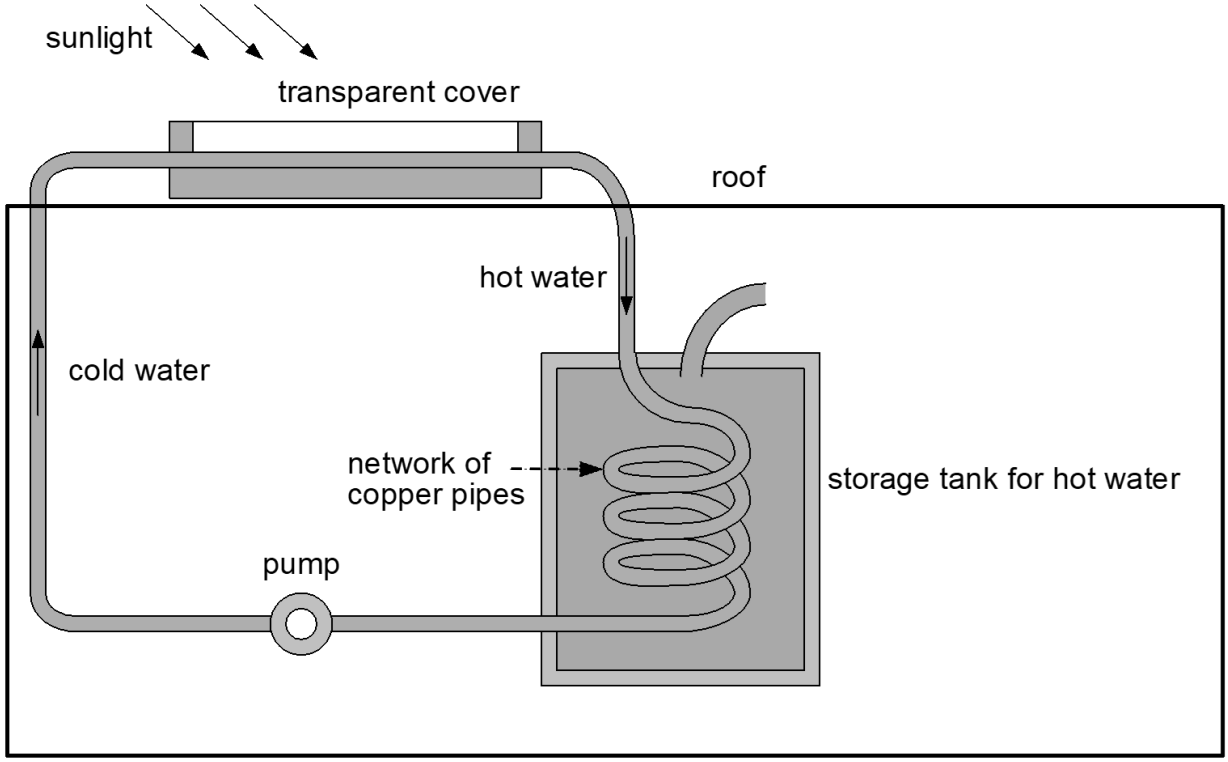


Fig. 1.1

(a) Name the process by which heat is transferred from the sun to the surface of the pipes.

.....……..... [1]

(b) The pipes on the roof are painted to increase the rate of heat transfer between the sun and the pipes.

Suggest a suitable colour for the pipes. Explain your choice of colour.

……

…….....[2]

(c) Suggest another way by which the rate of heat transfer from the sun to the pipes can be increased.

……

……..... [1]

(d) Copper pipes are used in the storage tank to increase the rate of heat transfer.

Explain why copper is used as the material for the pipes in the storage tank.

……

…… [1]

2 A lorry and a motorcycle move through a soft ground. **Table 2.1** shows the weight and the total contact area the tyres make with the ground for each vehicle.

	lorry	motorcycle
weight/ N	31 000	2 200
total contact area the tyres make with the ground/ m^2	3.0	0.18

Table 2.1

(a) Calculate the pressure exerted by the lorry and the motorcycle on the ground.

(i) pressure exerted by lorry = …… Pa [1]

(ii) pressure exerted by motorcycle = …… Pa [1]

(b) State the vehicle that will make the deeper depression on the ground.

…… [1]

3 A substance, initially in the solid state, was heated. The temperature was taken at regular intervals.
The temperature-time graph was plotted as showin in **Fig. 3.1.**

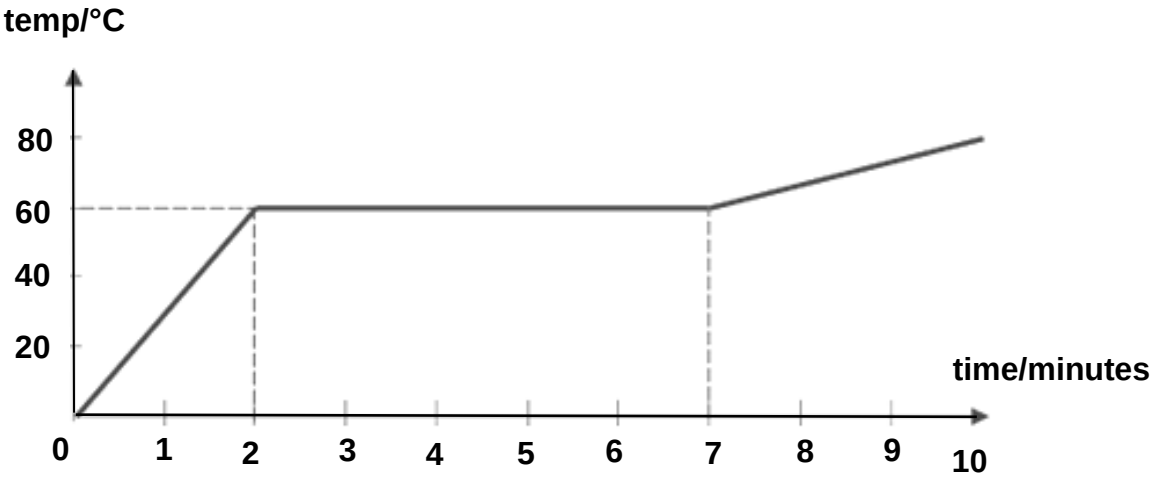


Fig. 3.1

(a) Using the graph in **Fig. 3.1**, determine

(i) the state(s) of the substance at time t= 4 minutes,

…… [1]

(ii) the melting point of the substance.

…… [1]

(b) The temperature of the substance did not change between 2 to 7 minutes even though heat was supplied constantly throughout the whole process.

Explain this observation.

……

……

……[1]

4 **Fig. 4.1** shows a uniform metre rule XY pivoted at its mid-point (50 cm mark).
Two masses of weight 25 N and 20 N, are suspended from the beam.
The 25 N weight is suspended at the 20 cm mark on metre rule.
The 20 N weight is suspended at 80 cm mark on metre rule.

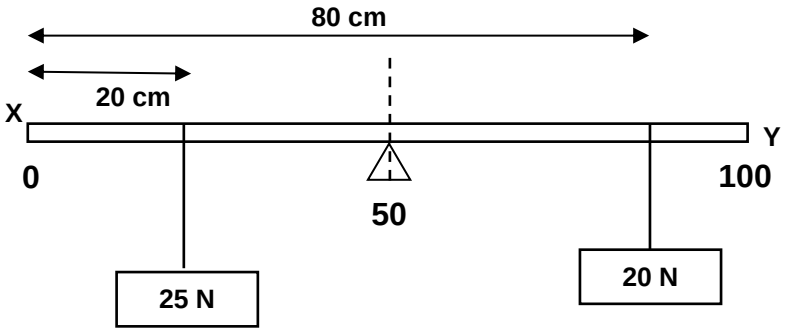


Fig. 4.1

(a) Will the end X of the beam move upwards or downwards?
Use calculated values to support your answer.

End X of the beam moves …….. [2]

(b) A downward force of 10 N is now applied on the beam in order to balance it.

Write down the position on the metre rule that the downward force should be placed in order to balance it?

position on metre rule ……. cm mark [1]

********** **End of Section A** **********

Section B (16 marks)
Answer any **TWO** questions in the spaces provided.

5 **(a)** **Fig. 5.1** shows an electrical circuit containing a battery of emf 12V, ammeters **A_1** and **A_2** and three resistors.

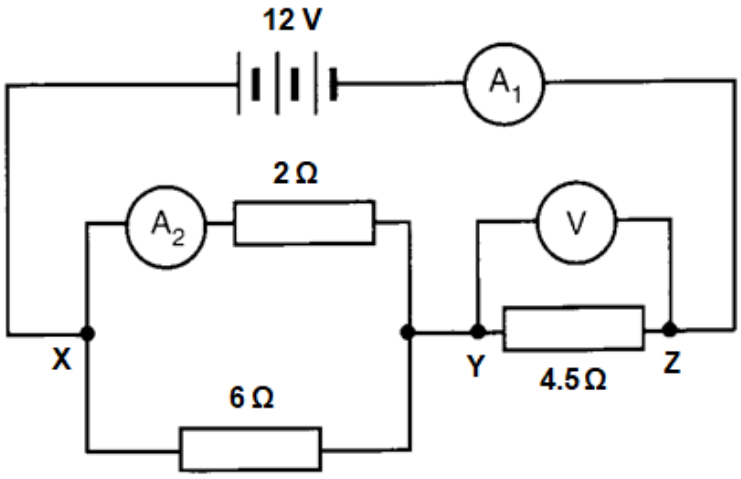


Fig. 5.1

(i) Calculate the resistance between **X** and **Y**.

resistance between **X** and **Y** = …… Ω [1]

(ii) Calculate the resistance between **X** and **Z**.

resistance between **Y**and **Z** = …… Ω [1]

(iii) If the battery has negligible internal resistance, what will be the readings of the voltmeter **V** and ammeters **A_1** and **A_2**?

reading of voltmeter **V**= …… V [1]

reading of ammeter **A_1**= …… A [1]

reading of ammeter **A_2**= …… A [1]

(b) Fig. 5.2 shows the three wires of an electrical mains supply connected to a water heater. The live wire carries a current of 4 A.

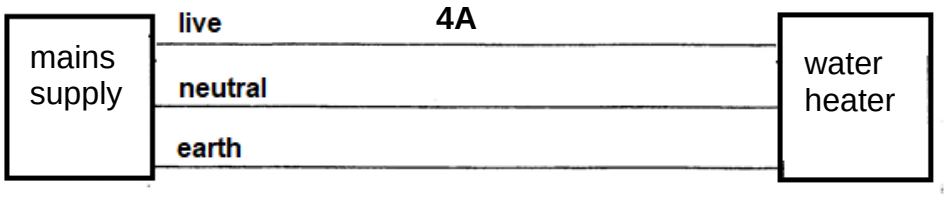


Fig. 5.2

(i) If the water heater is operating properly, state the size of currents in the neutral and earth wires?

current in neutral wire = …… A and

current in earth wire = …… A [1]

(ii) Describe the electrical fault which the earth wire is protecting against.

……

……[1]

(iii) Hence describe how the earth wire works to protect against the electrical fault in your answer to **(ii)**.

……

……[1]

6 **(a) Fig. 6.1** shows the speed-time graph of a bus travelling from town A to B and then to C. Total total journey takes 50 minutes (3000 seconds).

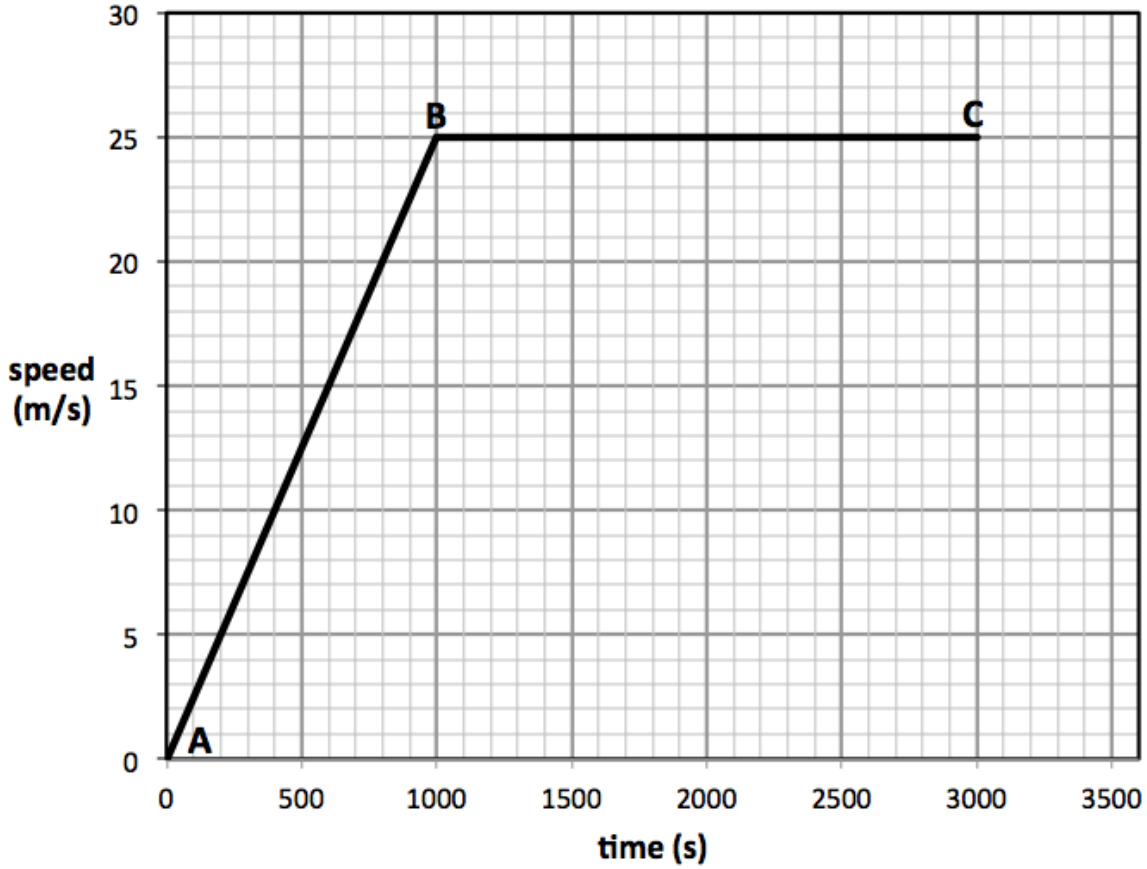


Fig. 6.1

(a) Describe the motion of the bus along section **BC** (1000 to 3000 s).

……

……[1]

(b) At **C**, the bus starts to decelerate uniformly to a stop in 600 s.
On **Fig. 6.1**, plot the graph for the last 600 s of the journey. [1]

(c) Calculate the total distance travelled by the bus in 3600 s.

total distance travelled ……m [2]

(d) (i) Calculate the acceleration of the bus along section **AB**.

acceleration …….m/s^2 [2]

(ii) If the mass of the bus is 5000 kg, what is the minimum driving force needed to be produced in the engine to attain this acceleration along section **AB**? (Ignore friction and air resistance)

driving force …….N [2]

7 **(a)** John, together with his skateboard, has a total mass of 60 kg. He skates from point **A**, with a constant speed of 5 m/s on a smooth flat road, to a ramp at point **B** to jump up a short wall of 3.0m to point **D** as shown in **Fig. 7.1**.

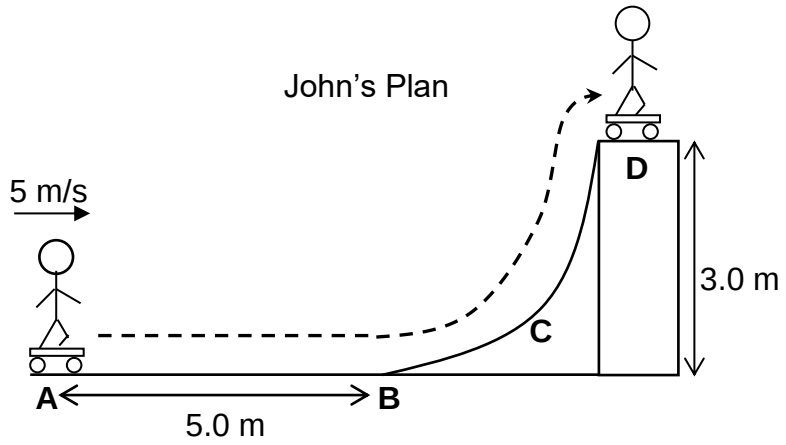


Fig. 7.1

(i) Calculate the kinetic energy of John and his skateboard at point **A**.

kinetic energy ……J [1]

(ii) A friend, Peter, believes that John will not be able to reach D on top of the wall. Explain, showing the necessary calculations, if he is correct.

……

……

……

……[2]

(b) Fig. 7.2 shows the displacement-distance graph of a wave travelling along a rope at time t = 0.60 s.

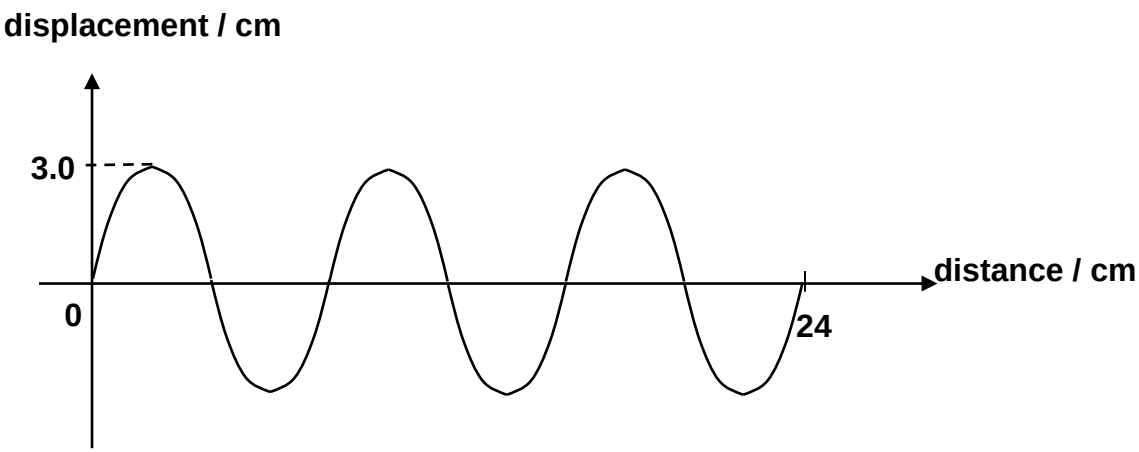


Fig. 7.2

Fig. 7.3 shows the displacement-time graph of a point on the rope.

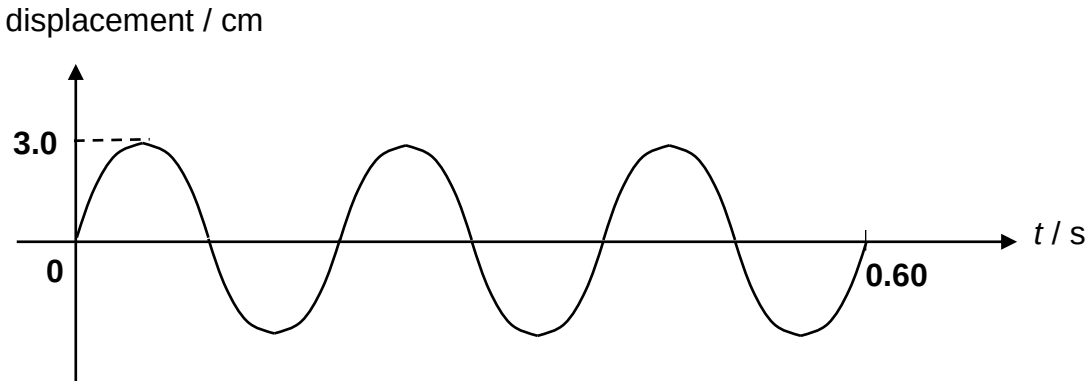


Fig. 7.3

(i) Using the graphs above, find the wavelength and period of the wave.

wavelength …….m [1]

period …….N [1]

(ii) Hence or otherwise, calculate the speed of the wave.

speed …….m/s [1]

(c) Fig. 7.4 shows an adult dolphin makes a sound to communicate with its baby

Fig. 7.4

Explain, using ideas on molecules, how the sound wave is transmitted through the water to the baby dolphin.

……

……

……

……

…… [2]

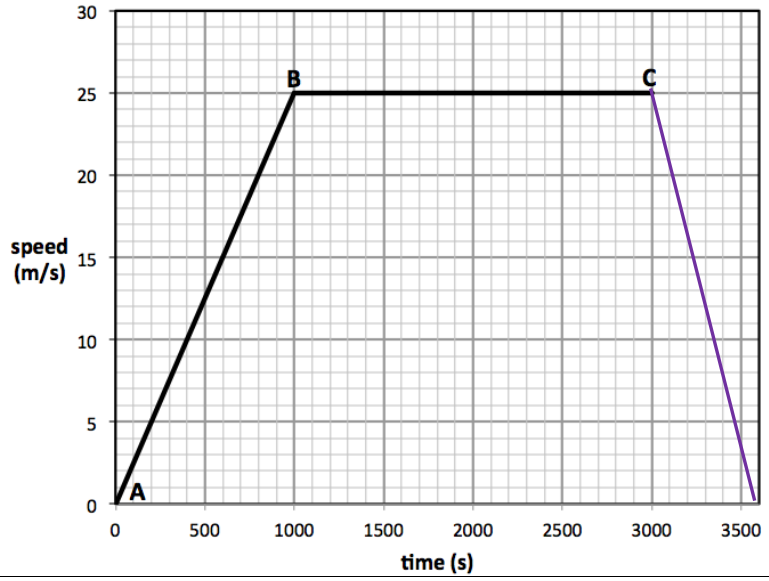
********** **End of Paper** **********

Mark scheme (4NA PRELIM SCIENCE PHYSICS)

MCQ :

Q 1–5: DBDBB Q 6–10:AAACB Q 11– 15 : DCCDC Q 16 – 20:DCBAB

1	(a) radiation	1
	(b) The pipes should be painted dull black. Dull black surfaces are good absorbers of radiation.	1 1
	(c) Increase the surface area of the pipes exposed to the sun/Increase roughnessof the surface of pipes.	1
	(d) Copper is a metal and metals are good conductor of heat.	1
2	(a) (i) Pressure exerted by lorry = 31 000/ 3.0 = 10333 = 10000 Pa or 10300 Pa	 1
	(ii) Pressure exerted by motorcycle = 2200/ 0.18 = 12 222 = 12 000 Pa or 12 200 Pa	 1
	(b) Motorcycle	1
3	(a)(i) solid and liquid (ii) 60 °C	1 1
	(b)Heat is taken in by the substance to overcome/break the intermolecular bonds and change it from solid state to liquid state. [There is no change in average internal KE of molecules]	1 1
4	(a) ACW moment = 25 N x 30 cm = 750 Ncm CW moment = 20 N x 30 cm = 600 Ncm End X moves downward as ACW moment is greater than CW	1 1
	(b) At 60 cm mark on metre rule	1
5	(a) (i) 1/R = ½ + 1/6 R = 1.5 Ω	 1
	(ii) 1.5 + 4.5 = 6.0 Ω	1
	(iii) V = IR = 2(4.5) = 9.0 V A_1 = V/R = 12/6 = 2.0 A A2 = ¾ (2) = 1.5 A OR A2 = V/R = 3/2 = 1.5 A	1 1 1
	(b) (i) current in neutral wire= 4A current in earth wire = 0 A	 1
	(ii) Live wire touches metal casing (due to damaged insulation)	1

	(iii) Provides a low-resistance path and direct excess current to the ground, OR prevent electrical shock/electrocution to the user.	1
6	(a) Bus is travelling with constant speed of 25 m/sOR zero acceleration	1
	(b) 	1
	(c) Area under graph = ½ (3600 + 2000)25 = 70 000 m	1
	(d) (i) Acceleration = (v-u)/t = (25-0)/1000= 0.025 m/s^2	1 1
	(ii) F = ma = 5 000 x 0.025 = 125 N	1 1
7	(a) (i) KE at A = ½ (60)(5^2) = 750 J	1
	(ii) gpe at D = (60)(10)(3) = 1800 J Peter is correct. Total energy at A (750J) is less than total energy at D(1800J). Since energy cannot be created, John cannot reach D	1 1
	(b) (i) wavelength = 8 cm Period =0.20 s	1 1
	(ii) v = 8 cm/0.20 = 40 cm/s = 0.4 m/s	1
	(c) The water particles vibrate in a direction parallel to the direction of the propagation of the wave motion passing on the energy to neighbouring water particles when they collide. The sound creates a series of compression and rarefactions in the layer of water particles between the dolphins.	1 1

[Total: 8 marks]