Name	Class				Index Number		

BROADRICK SECONDARY SCHOOL
SECONDARY 3 EXPRESS
END-OF-YEAR EXAMINATION 2019

SCIENCE (PHYSICS/CHEMISTRY) 5076/01

Paper 1 Multiple Choice October 2019

Additional Materials: Multiple Choice Answer Sheet 1 hour

READ THESE INSTRUCTIONS FIRST

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

There are **forty** 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 answer sheet.

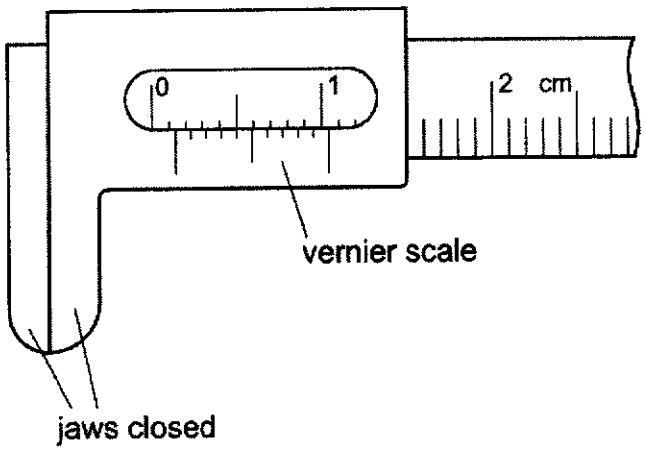
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
The use of an approved scientific calculator is expected, where appropriate.

This question paper consists of 1X printed pages including this page.

Setter: Mr Foo SK and Mr Ivan Liang

[Turn over

1 Vernier calipers are shown with the jaws closed.



What is the zero error?

A 0.04 cm **B** 0.05 cm **C** 0.14 cm **D** 0.15 cm

2 Which is the correct statement about force and velocity?

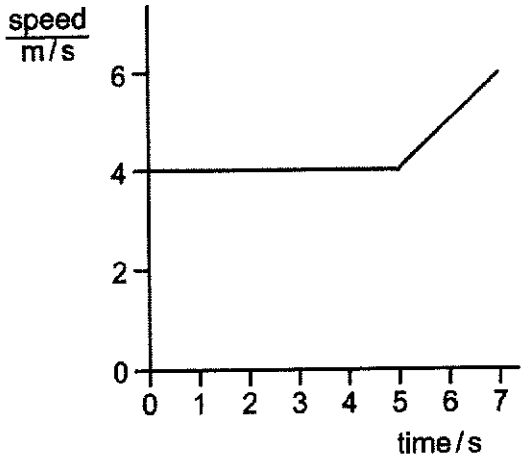
A Force and velocity are both scalars.

B Force and velocity are both vectors.

C Force is a scalar, velocity is a vector.

D Force is a vector, velocity is a scalar.

3 The graph shows part of a journey made by a cyclist.



How far did the cyclist travel in 7 s?

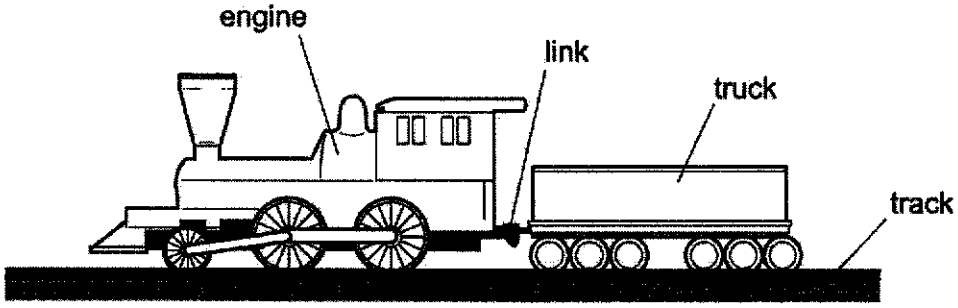
A 28 m **B** 30 m **C** 32 m **D** 42 m

4 A motorist starts out on a 210 km journey at 8 am. At 10 am he stops for a 30 minute break after covering 180 km. The motorist completes the journey at 11 am.

What is his average speed in covering the 210 km?

A 60 km/h **B** 70 km/h **C** 84 km/h **D** 90 km/h

5 An engine pulls a truck at constant speed on a level track.



The link between the truck and the engine breaks. The driving force on the engine remains constant.

What effect does this have on the truck and on the engine?

	truck	engine
A	slows down	speed stays constant
B	slows down	speeds up
C	stops immediately	speed stays constant
D	stops immediately	speeds up

6 A car travelling at 30 m/s has to brake suddenly to avoid an accident. A man of mass 80 kg is inside the car and it takes 3 seconds for the car to stop completely.

What is the average force the man exerts onto his safety belt?

A 240 N **B** 400 N **C** 500 N **D** 800 N

7 Which of the following situations is an example of a force acting over a large area to produce a small pressure?

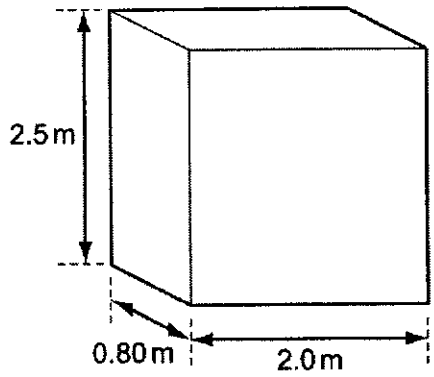
A a builder hammering a nail into a piece of wood

B a cook using a sharp knife to cut vegetables

C a nurse pushing a needle into a patient's arm

D a soldier marching in flat-soled boots

8 The base for a statue rests on level ground. It is made from stone and is 2.0 m long, 2.5 m high and 0.80 m wide. It has a weight of 96 000 N.



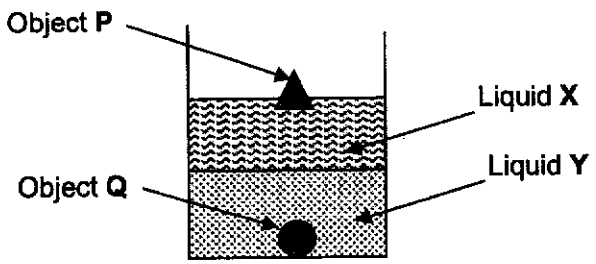
What is the pressure that the base exerts on the ground?

A 19 kPa **B** 24 kPa **C** 48 kPa **D** 60 kPa

9 Leo can jump a maximum height of 1 m on Earth.
On another planet with gravitational field strength 2 N/kg, what is the maximum height he can jump?

A 0.2 m **B** 1 m **C** 2 m **D** 5 m

10 Two objects, **P** and **Q**, are placed in a beaker containing two liquids **X** and **Y** which do not mix.



Which of the following statements is incorrect?

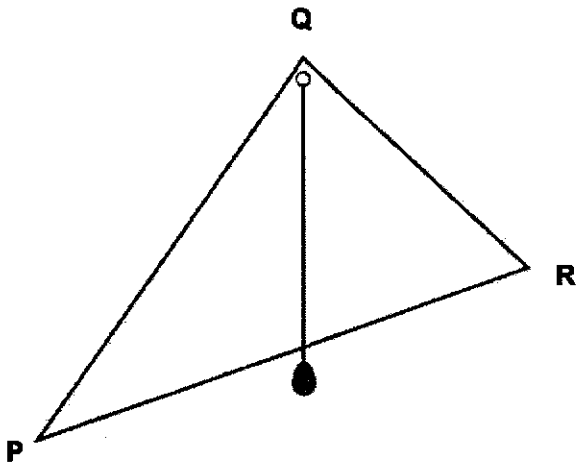
A Liquid **X** is the less dense liquid.

B Liquid **Y** is denser than object **P**.

C Object **P** is denser than liquid **X**.

D Object **Q** is the denser object.

11 A student finds the centre of gravity of a triangular lamina **PQR**.
He drills a small hole at **Q**. He suspends the lamina from a pin through the hole at **Q** so that the lamina swings freely. He then hangs a plumb-line from the pin at **Q**, as shown.
He marks the position of the plumb-line on the lamina.



To determine the location of the centre of gravity, the student then repeats the experiment but with one change.

What is the change?

A He suspends the lamina from the hole at **Q**, with **R** on the left and **P** on the right.

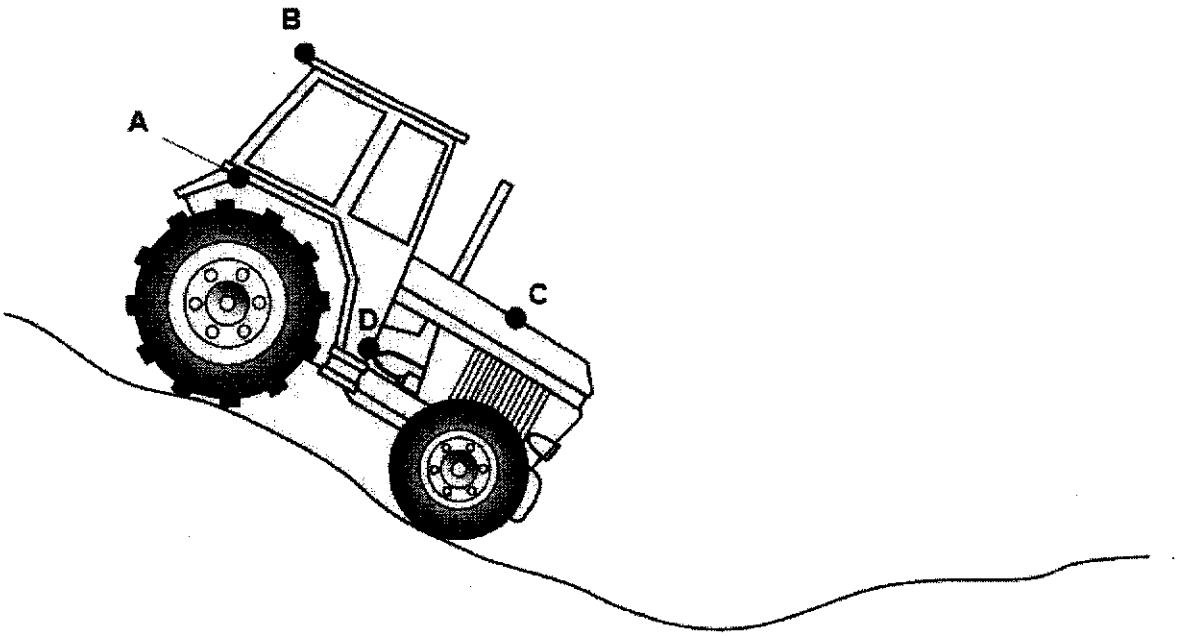
B He suspends the lamina from a pin through a hole at **R**.

C He uses a heavier weight on the plumb-line.

D He uses a longer plumb-line.

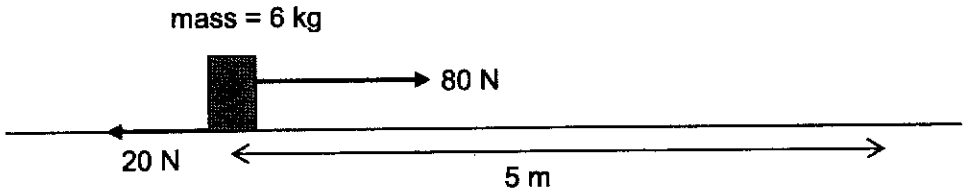
12 A tractor is being used on rough ground.

What is the safest position for its centre of gravity?



13 A man exerts a 80 N force on a load of mass 6 kg along a rough surface. The frictional force acting on the load is 20 N.

Given that the box moves 5 m horizontally in 30 s, what is the **useful work done** by the man?



A 100 J **B** 200 J **C** 300 J **D** 400 J

14 A motorcycle is travelling with a uniform speed along a horizontal road.

Which of the following describes the power developed by the motor engine?

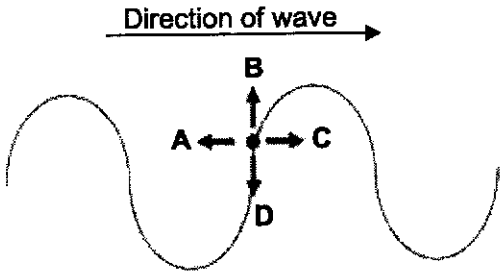
A constant.

B decreasing but not uniformly.

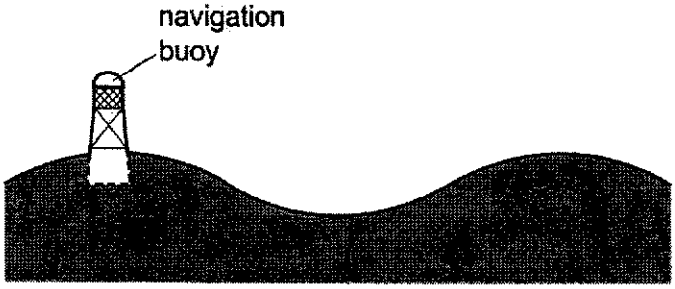
C increasing but not uniformly.

D uniformly increasing.

15 The diagram below shows a transverse wave.
What would be the direction of motion of the particle as the wave moves past in the next instant?



16 A navigation buoy floating on the sea oscillates up and down as a wave passes.



In exactly two minutes, six complete wavelengths pass the buoy.

What is the frequency of the waves?

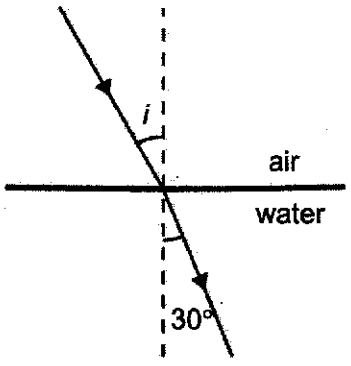
A 0.050 Hz **B** 0.33 Hz **C** 3.0 Hz **D** 20 Hz

17 A plane mirror forms an image of an object placed in front of it.

Which row describes the image?

	image type	image size
A	real	same size as object
B	real	smaller than object
C	virtual	same size as object
D	virtual	smaller than object

18 A ray of light travels from air to water as shown below. Given that the refractive index of water is 1.3, what is the angle of incidence *i*?



A 22.7° **B** 23.1° **C** 39.0° **D** 40.5°

19 Which application may use the part of the electromagnetic spectrum called microwaves?

A cooking vegetables

B detecting small cracks in metals

C gaining a sun-tan

D lighting a fluorescent tube

20 Red light and violet light have different frequencies and different wavelengths.

Which color light has the higher frequency and which has the larger wavelength?

	higher frequency	larger wavelength
A	red	red
B	red	violet
C	violet	red
D	violet	violet

Q21 – Q40 Sci Chem

Name	Class				Index Number		

BROADRICK SECONDARY SCHOOL
SECONDARY 3 EXPRESS
END-OF-YEAR EXAMINATION 2019

SCIENCE(PHYSICS) 5076/02

Paper 2 October 2019

Candidates answer on the Question Paper 1 hour 15 minutes

READ THESE INSTRUCTIONS FIRST
Write your name, index number and class on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid. If working is needed for any question it must be shown with the answer. Omission of essential working will result in loss of marks. Calculators should be used where appropriate.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B
Answer any **two** questions.
Write your answers in the spaces provided on the question paper.

The number of marks is given in brackets [ ] at the end of each question or part question.
[Take g to be 10 m/s^2 or the weight of 1 kg to be 10 N]

Target Grade:
Actual Grade:
For Examiner's Use
65

This question paper consists of **17** printed pages including this page.

Setter: Mr Foo SK

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Section A (45 Marks)

Answer **all** the questions in the answer booklet provided.

1 The length of a rectangular sheet of plastic is measured using a short ruler, as shown in Fig. 1.1 (not full size).

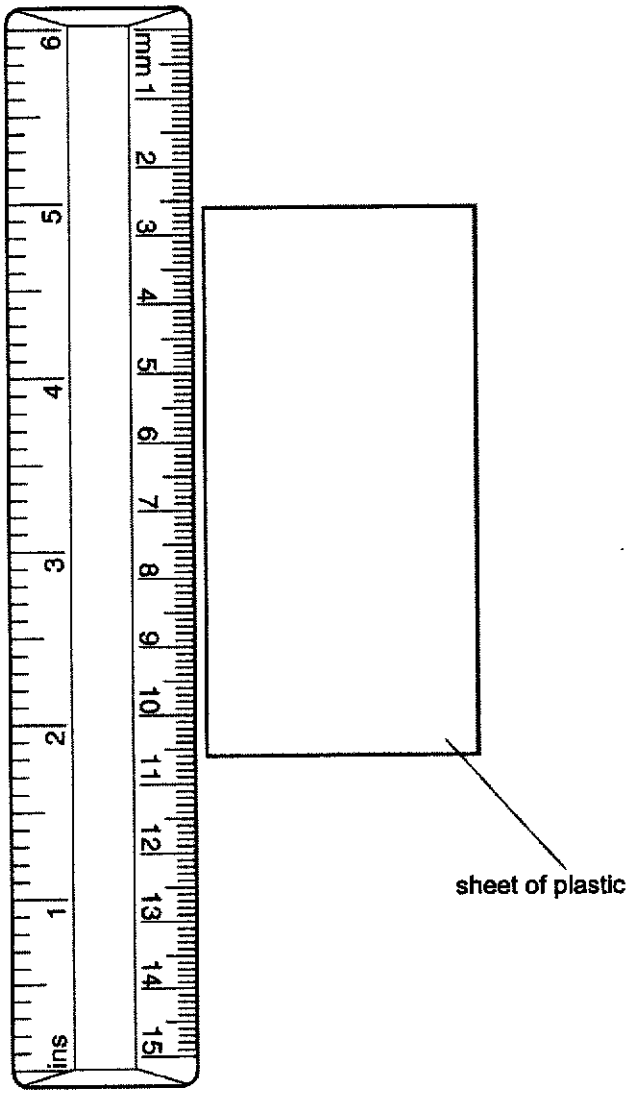

Fig. 1.1 (not full size)

(a) From the ruler in Fig. 1.1, find the length, in cm, of the sheet.

length = ... cm [1]

(b) The sheet of plastic in **(a)** has a thickness of 0.50 cm and a width that is half its length.

Calculate the volume of the sheet of plastic.

volume = ... cm^3 [2]

(c) The plastic has a density of 1.2 g/cm^3.

(i) Calculate the mass of the sheet.

mass = ... g [2]

(ii) Which laboratory instrument could be used to check the mass of the sheet?

..... [1]

2 Drops of water from a cracked gutter fall past the window of a Physics student's room, as shown in Fig. 2.1.

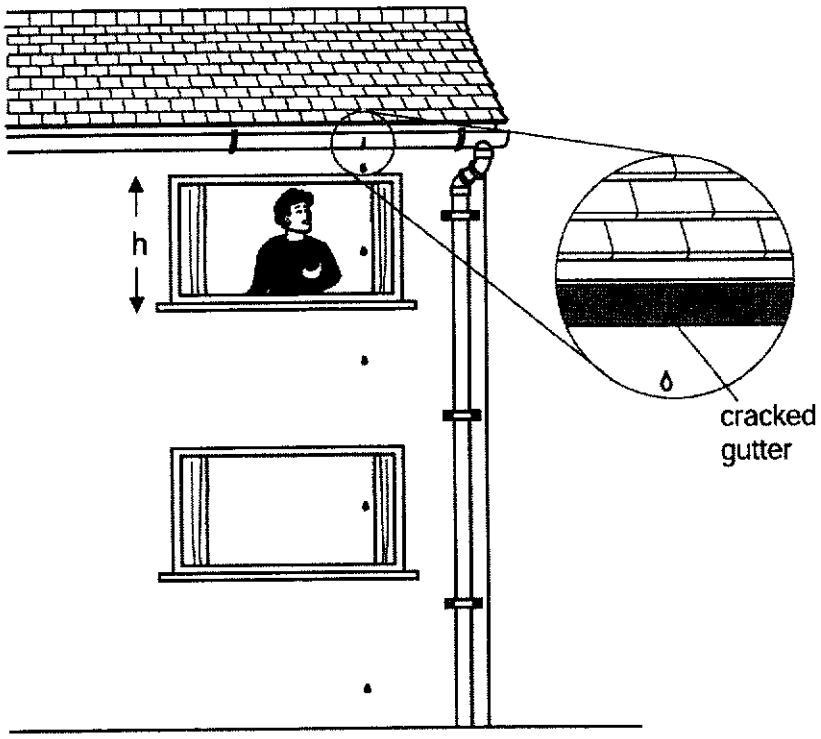

Fig. 2.1

The student uses a digital stopwatch to find the time between one drop and the next. To do this he

- sets the stopwatch to zero,
- then, starts the stopwatch as a drop comes into view at the top of the window,
- then, stops the stopwatch 40 drops later.

The appearance of the stopwatch after 40 drops is shown in Fig. 2.2.

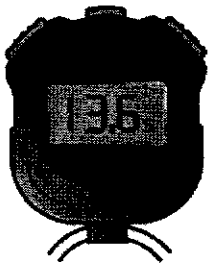

Fig. 2.2

(a) State the reading on the stopwatch.

reading = ... s [1]

(b) Calculate the time interval between one drop and the next.

time = ... s [2]

(c) Explain why it is better to time 40 intervals than to time just 1 interval.

.....

..... [1]

(d) Using Fig. 2.1, estimate the time for a drop to fall from the top of the upper window to the ground.

time = ... s [3]

(e) Fig. 2.1 shows that the drops get further apart as they get closer to the ground.

Explain why this happens.

.....

.....

..... [1]

3 Fig. 3.1 is a graph showing the motion of a car during the first few seconds of a race.

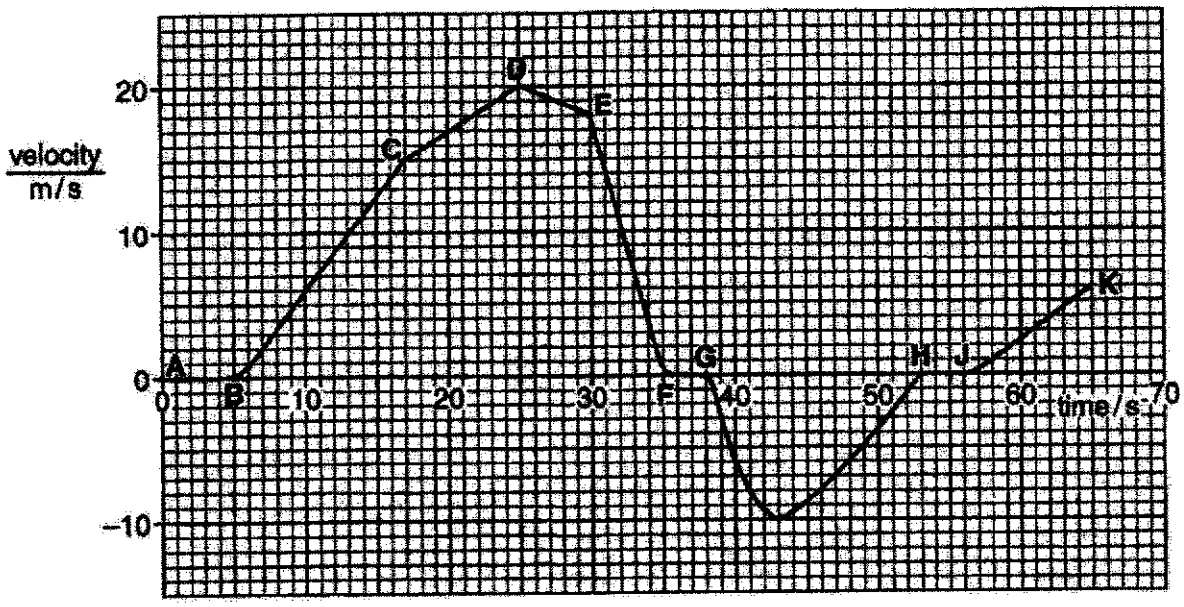

Fig. 3.1

(a) From **A** to **F**, Fig. 3.1 shows the car

- braking
- colliding with another car and stopping
- increasing speed
- increasing speed at its greatest rate
- stationary

but not in this order.

Use each phrase once only to describe the motion of the car between point **A** and point **F**.

A to **B** .....

B to **C** .....

C to **D** .....

D to **E** .....

E to **F** ..... [2]

(b) Describe the motion of the car between points **G** and **H.**

.....

.....

.....

..... [3]

(c) Calculate the average acceleration of the car between points **C** and **D.**

acceleration = ... m/s^2 [2]

4 **(a)** Define the principle of moments.

.....

..... [2]

(b) Fig. 4.1 shows a light rod that is hung from a ceiling.

A weight of 11.5 N is hung 4.0 cm from the supporting rope on one side of the rod. A weight of 5.0 N and 2.0 N is hung 8.0 cm and d cm away from the supporting rope on the other end of the rod respectively.

The rod is in equilibrium.

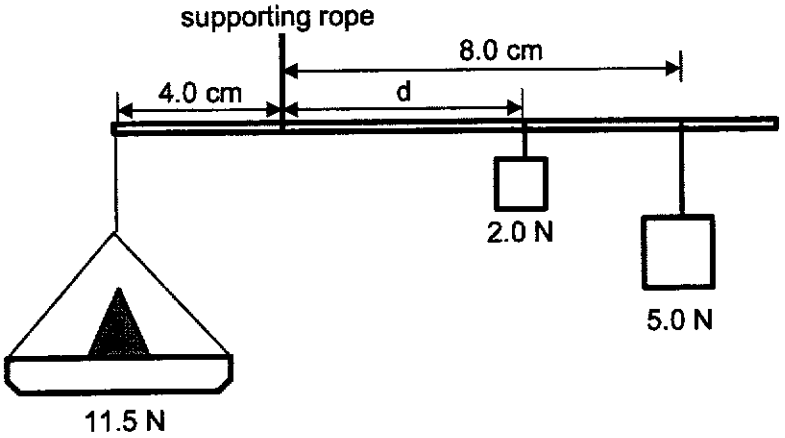

Fig. 4.1

Calculate d, the distance where the weight of 2.0 N should be placed from the supporting rope.

d = ... cm [2]

5 (a) Hafiz weighing 65 kg picked up his 30 N schoolbag.
He lifted it 50 cm above the floor and walked 10 m to his table.

(i) What was the total work done by the boy in lifting his schoolbag and in walking 10 m with the schoolbag?

total work done = ... J [2]

(ii) What was the work done against friction if he had dragged the schoolbag at constant speed for 10 m along the floor instead of lifting it.
Assume that friction between the school bag and the floor is 30 N.

work done ..... J [2]

(b) Hafiz threw his pencil of mass 0.020 kg vertically upward with an initial speed of 2 m/s.

(i) Calculate its initial kinetic energy.

kinetic energy = ... J [1]

(ii) State its kinetic energy when it reaches its maximum height.

kinetic energy = ... J [1]

(iii) Determine its maximum height.

maximum height = ... m [2]

6 Fig. 6.1 shows circular wavefronts produced at the centre of a circular ripple tank.

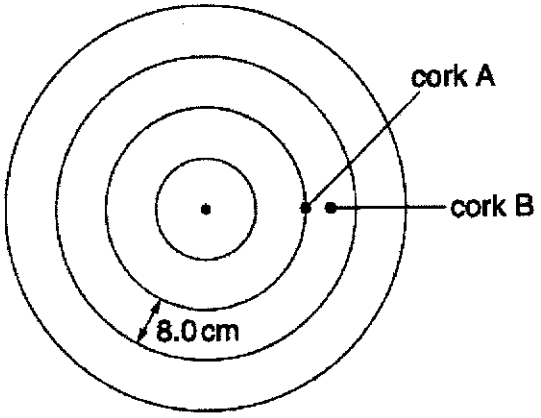

Fig. 6.1

Two corks, **A** and **B**, float on the water in the ripple tank. They move up and down on the surface of the water as the wave passes.

Fig. 6.2 shows how the displacement of **A** varies with time.

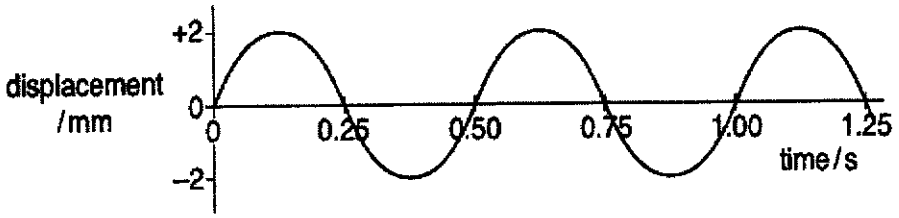

Fig. 6.2

(a) Define the *amplitude* of a wave.

..... [1]

(b) From Fig. 6.1 and Fig. 6.2, determine the wavelength, amplitude and the period of the wave.

(i) wavelength ..... m

(ii) amplitude ..... m

(iii) period ..... s [3]

(c) Hence, calculate the speed of the wave.

speed: ..... m/s [2]

7 Fig. 7.1 shows a periscope that uses two plane mirrors.

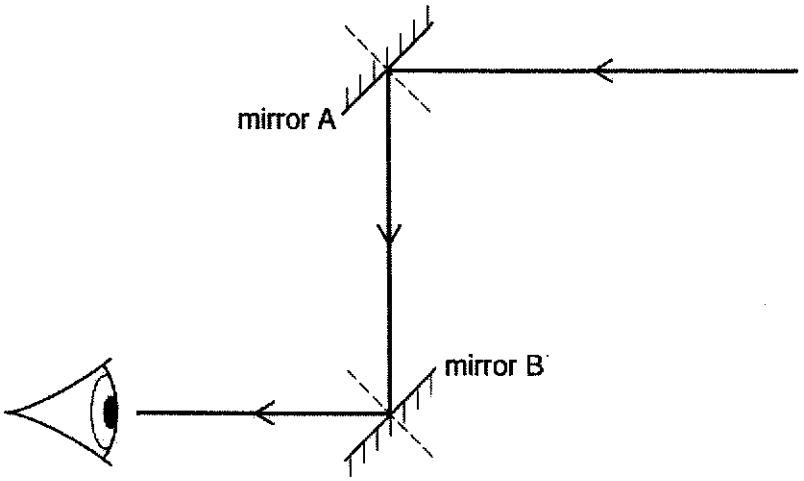

Fig. 7.1

(a) On Fig. 7.1, clearly mark the angle of incidence *i* and the angle of reflection *r* at mirror A. [1]

(b) State the equation linking *i* and *r*.

..... [1]

8 Fig. 8.1 shows an object and its image.

Fig. 8.1

(a) Draw two light rays that pass from the object to show how the image is formed. In the diagram, mark and label the position of the lens, L and the focal point, F. [2]

(b) Name one instrument which makes use of this setup.

..... [1]

(c) The image formed in this setup is virtual.
What changes can be made to this setup in order to form a real image?

.....

..... [1]

Section B (20 Marks)
Answer any **two** questions from this section.

Write your answers in the spaces provided.

9 **(a)** Fig. 9.1 shows the forces acting on an arrow just before it is being released.

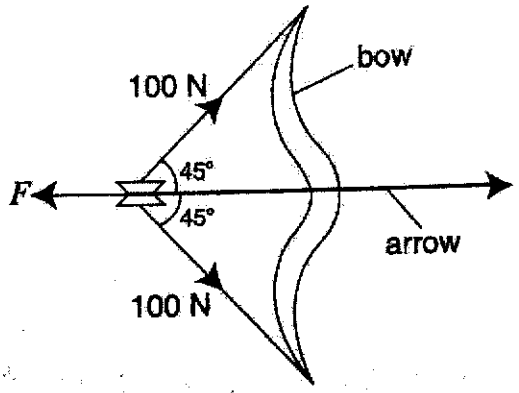

Fig. 9.1

(i) By means of a scaled diagram, determine the resultant force acting on the arrow due to the 100 N forces in the bow.

scale = ... [1]

resultant force = ... [3]

(ii) Hence, determine the horizontal force F needed to hold the arrow in this position.

F = ... [1]

(iii) If the angle between the 100 N forces is reduced, state whether the following quantities will be decreased, increased or remained the same.

Horizontal force F: .....

Acceleration of the arrow after it is released: ..... [2]

(b) Friction can be both useful and a nuisance.

(i) State 2 ways of reducing friction.

.....

.....

..... [2]

(ii) State one situation in which friction is useful.

.....

..... [1]

10 Fig 10.1 shows three lorries and their respective weights. All three lorries have identical wheels and tyres. There are four wheels on Lorry **A** and on Lorry **B**, and six wheels on Lorry **C**.

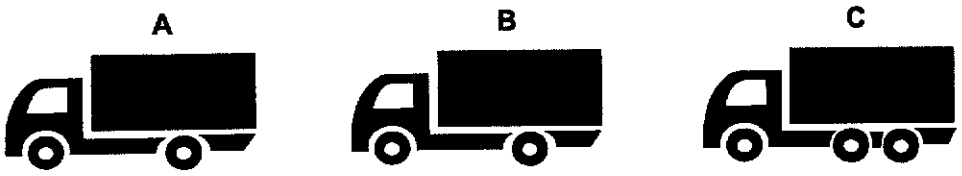

Fig. 10.1

(a) **(i)** Define *pressure*.

..... [1]

(ii) Which lorry leaves the deepest track when driven across soft ground? Explain why, in terms of pressure.

.....

.....

.....

..... [2]

(iii) If the total area of the wheels in contact with the ground for the lorry in **(a)(ii)** is 0.02 m^2, calculate the pressure acting on the ground for that lorry.

pressure = ... [2]

(b) Table 10.2 shows the speed of the three lorries at different times, t

lorry	speed at $t = 0$	speed at $t = 5$ s	speed at $t = 10$ s	speed at $t = 20$ s	speed at $t = 40$ s
A	0	4 m/s	8 m/s	16 m/s	32 m/s
B	0	6 m/s	12 m/s	18 m/s	24 m/s
C	0	8 m/s	16 m/s	20 m/s	20 m/s

Table 10.2

(i) State what is meant by *uniform acceleration*.

.....

..... [2]

(ii) State which lorry has a uniform acceleration.
Explain your answer using the data in Table 10.2.

.....

.....

..... [2]

(iii) Write down one assumption that you made in answering **(b)(ii)**.

.....

..... [1]

[Turn over

11 Electromagnetic radiation can be used for sending television signals to different parts of the Earth.

(a) Fig. 11.1 shows two methods of sending television signals to points on the Earth's surface.

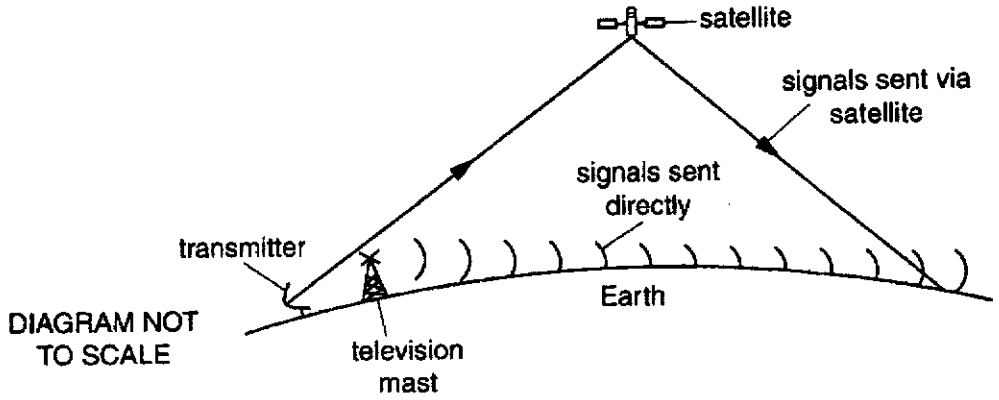

Fig. 11.1

One method is to transmit waves directly to the receiver.
A second method is to send the signals via a satellite in space.

(i) State which portion of the electromagnetic spectrum is used for each method of transmitting television signals.

.....

..... [2]

(ii) A transmitter on Earth sends out signals of frequency 6000 MHz.
State the speed of electromagnetic waves in a vacuum.
Calculate the wavelength of the signal from the transmitter.

speed of electromagnetic waves in vacuum = ...

wavelength = ... [4]

(b) Another way to send signals using electromagnetic radiation is by means of optical fibres made of glass, as shown in Fig. 11.2.

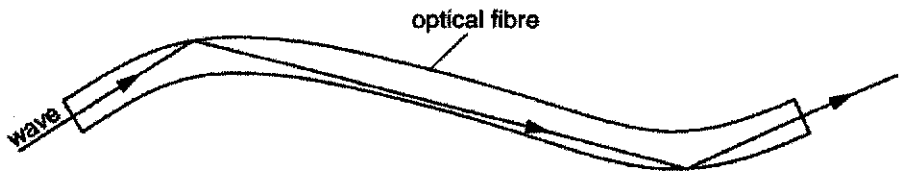

Fig. 11.2

Light and infra-red radiation can both be transmitted along optical fibres.
State two other similarities between light and infra-red radiation.

.....

.....

.....

..... [2]

(c) The radiation passes along the optical fibre without escaping from the sides as a result of internal reflection. Explain why total internal reflection occurs in the optical fibre.

.....

.....

.....

..... [2]

End of Paper

Paper 1 (20 marks)

1	C	6	D	11	B	16	A
2	B	7	D	12	D	17	C
3	B	8	D	13	C	18	D
4	B	9	D	14	A	19	A
5	B	10	C	15	D	20	C

Paper 2 Section A (45 Marks)

1 (a) 8.0 cm [1]

(b) $8 \times 4 \times 0.5$ e.c.f. from (a) [1]
$16\ cm^3$ e.c.f. [1]

(c) (i) $D = M / V$
$1.2 = mass / 16$ [1]
mass = 19.2 g e.c.f. [1]

(ii) balance (accept spring balance) [1]

Total = 6 m

2 (a) 13.6 s [1]

(b) 13.6 / 40 e.c.f. [1]
= 0.34 s e.c.f. [1]

(c) more accurate OR
errors less significant OR time for 1 interval too small [1]

(d) 4 intervals [1]
4 × **(b)** [1]
1.36 – 1.5 s e.c.f. [1]

(e) drops accelerate/go faster [1]

Total = 8 m

[Turn over

3 (a) A to B stationary
B to C increasing speed at its greatest rate
C to D increasing speed
D to E braking
E to F colliding with another car and stopping. All correct [2]
2 to 4 correct [1]

(b) Between G and H, the car is travelling
at non-uniform acceleration in the opposite direction till 10 m/s [1]
before decelerating non-uniformly to rest. [1]
mention of underlined points [1]

(c) $a = (v-u) / t = 20 - 15 / (25 - 17)$ [1]
$= 0.63\ m/s^2$ [1]

Total = 8 m

4 (a) When a system is in equilibrium, [1]
the sum of the clockwise moments about a pivot is equal to the sum of the anti-clockwise moment about the same pivot. [1]

(b) sum of CWM = sum of ACWM
$2.0 \times d + 5.0 \times 8.0 = 11.5 \times 4.0$ [1]
$d = 3.0$ cm [1]

Total = 4 m

5 (a) (i) work done = force x distance moved
$= 0.5 \times 30$ [1]
$= 15$ J [1]

(ii) work done against friction
$= 30 \times 10$ [1]
$= 300$ J [1]

(b) (i) $KE = \frac{1}{2} m v^2$
$= \frac{1}{2} \times 0.020 \times 2^2 = 0.04$ J [1]

(ii) 0 J [1]

(iii) Gain in GPE = Loss in KE
$0.020 \times 10 \times h = 0.04$ [1]
$h = 0.2$ m [1]

Total = 8 m

6 (a) Amplitude is the maximum displacement of a point from its rest position. [1]

(b) (i) wavelength = 0.08 m
(ii) amplitude = 0.002 m
(iii) period = 0.50 s [3]

(c) speed = wavelength / period
$= 0.08 / 0.50$ [1]
$= 0.16$ m/s [1]

Total = 6 m

7 (a) i and r both correctly marked [1]

(b) i = r in symbols or words NOT sin i = sin r [1]

Total = 2 m

8 (a) ray diagram [1]
label position of lens L and focal point F [1]

(b) magnifying glass [1]

(c) Move the object further than one focal length away from the lens. [1]

Total = 4 m

Paper 2 Section B (20 marks)

9 (a) (i) Scale: 1 cm to 10 N [1]
Correct and proper drawing of vector diagram [2]
Resultant force = 142 N (accept 140 to 144 N) [1]

(ii) F = 142 N e.c.f. [1]

(iii) horizontal force: increased [1]
acceleration after arrow is released: increased [1]

(b) (i) Any two reasonable answers [2]

(ii) Any one reasonable answer
(eg walking / holding objects / brakes) [1]

Total = 10 m

10 (a) (i) Force acting per unit area. [1]

(ii) A [1]
It has the biggest force acting on the ground
and the smallest contact area. [1]
hence the biggest pressure.

(iii) Pressure = Force / Area = 300 000 (e.c.f.) / 0.02 [1]
= 15 000 000 Pa e.c.f. [1]

(b) (i) the rate of change of velocity [1]
is the same. [1]

(ii) A [1]
For every 1s
the velocity changes by 0.8 m/s [1]

(iii) The speed increases by the same amount for every second. OR
The lorry travels in a straight line. [1]

Total = 10 m

11 **(a)** **(i)** **Radio waves** are being used to transmit television signal directly. [1]
Microwaves are being used to transmit television signal to satellite in space. [1]

(ii) Speed of EM wave = 3×10^8 m/s [1]
f = 6000 MHz = 6000×10^6 Hz = 6×10^9 Hz [1]

speed = frequency x wavelength
3×10^8 m/s = $(6 \times 10^9$ Hz) x λ [1]
λ = 0.05 m / 5×10^{-2} m [1]

(b) Both light and infra-red radiations are transverse way. [1]
They obey the law of reflection and refraction in glass. [1]

(c) The angle of incidence is greater than the critical angle of the glass optical fibre. [1]
The wave is from an optically denser medium onto optically lighter medium. [1]

Total = 10 m