PASIR RIS CREST SECONDARY SCHOOL
Mid Year Examination
Secondary Three Express

CANDIDATE NAME

CLASS / INDEX NUMBER

PHYSICS

6091/01

Paper 1 Multiple Choice

14 May 2019

Papers 1 & 2: **1 hour 40 mins**

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

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

There are **twenty** questions on 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 Answer Sheet.

Read the Instructions on the Answer Sheet very carefully.

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.
Take $g = 10\ m/s^2$ for all relevant questions.
The use of an appropriate scientific calculator is expected where appropriate.

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Parent's Signature

This document consists of **9** printed pages.

1. What is the order of magnitude of the diameter of earth?

   A 10^5

   B 10^6

   C 10^7

   D 10^8

2. A student determines the circumference of a golf ball.

   Which instrument gives a reading that is the circumference of the golf ball?

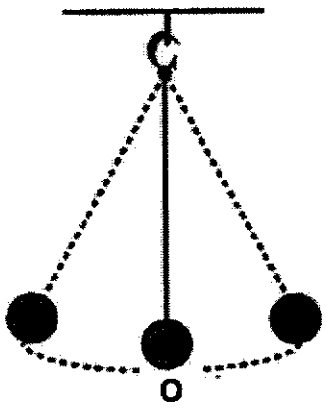
   A calipers

   B micrometer

   C rule

   D tape

3. A pendulum swings backwards and forwards passing through **O**, the middle point of the oscillation.



   The first time the pendulum passes through **O**, the stopwatch is started. The eleventh time the pendulum passes through **O**, the stopwatch is stopped. The reading is *T*.

   What is the period of the pendulum?

   A T/5

   B T/10

   C T/11

   D T/20

4. A vernier calipers is used to measure the diameter of a test tube.

With the jaws closed and no test tube, the reading is shown in diagram 1.

With the jaws closed around the diameter of the test tube, the reading is shown in diagram 2.

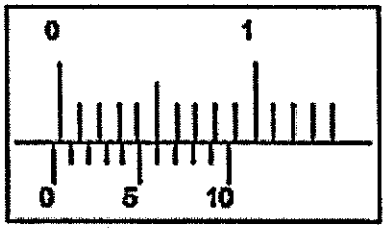


diagram 1

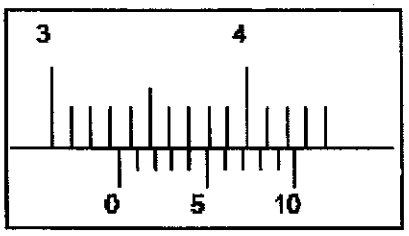


diagram 2

What is the diameter of the test tube?

A 3.28 cm

B 3.30 cm

C 3.38 cm

D 3.40 cm

5. A micrometer screw gauge is used to measure the diameter of a copper wire.

The reading with the wire in position is shown in diagram 1. The wire is removed and the jaws of the micrometer are closed. The new reading is shown in diagram 2.

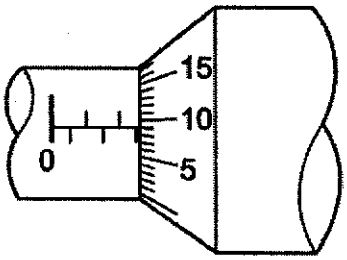


diagram 1

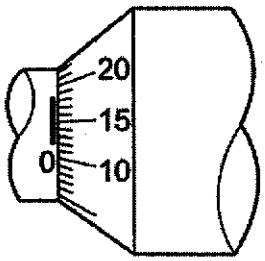


diagram 2

What is the diameter of the wire?

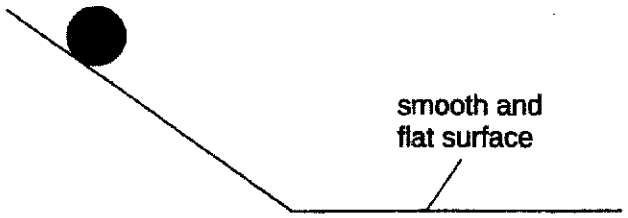
A 1.90 mm

B 2.45 mm

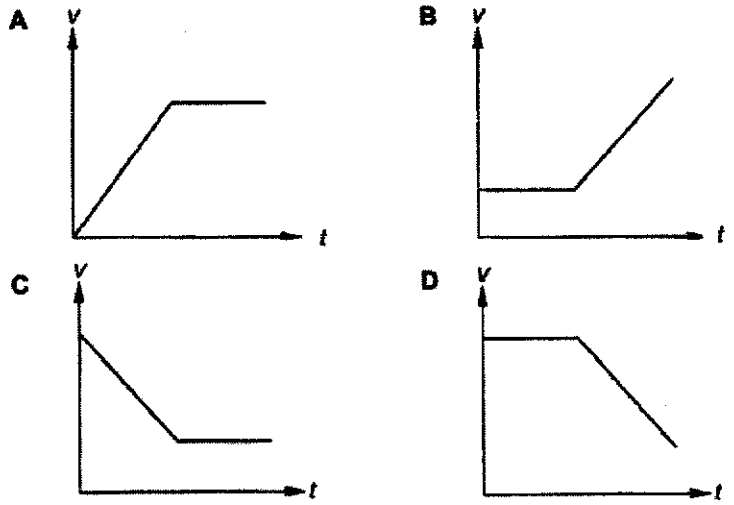
C 2.59 mm

D 2.73 mm

6. A ball is moving down a smooth ramp and reaches a smooth and flat surface.



Which velocity-time graph best represents the motion of the ball?



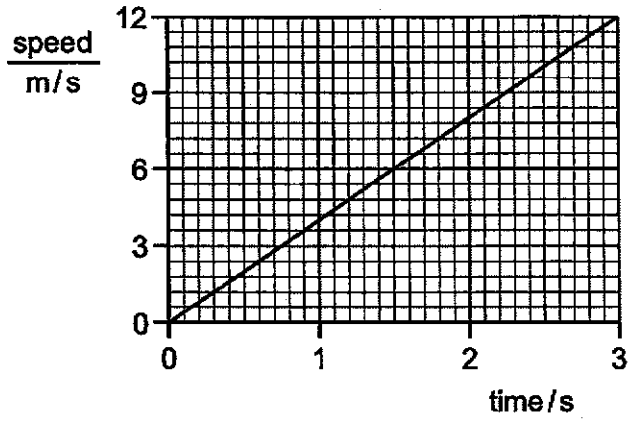
7. A car moving along a straight road undergoes a uniform acceleration of 3.0 m/s^2 for a period of 5.0 s. Given that the initial velocity of the car is 2.0 m/s, what is the final velocity of the car?

A 2.0 m/s
B 13 m/s
C 15 m/s
D 17 m/s

8. Which list contains only scalar quantities?

A distance, mass, speed
B acceleration, displacement, mass
C acceleration, distance, speed
D displacement, mass, velocity

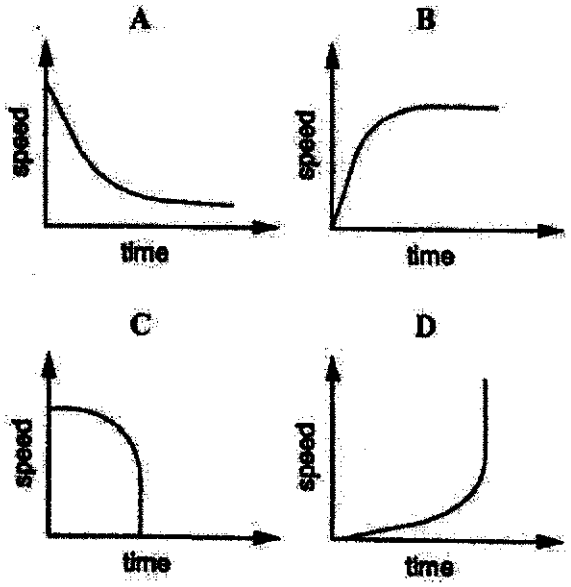
9. The graph shows the speed of a car as it moves from rest.



What is the average speed of the car during the first 3 s?

A 4.0 m/s **B** 6.0 m/s **C** 18 m/s **D** 36 m/s

10. Which of the following diagrams shows that the car is moving with increasing deceleration?



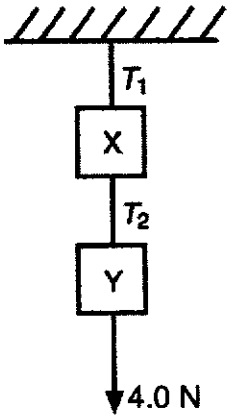
11. A tractor pulls a trailer at a constant speed.

The tractor exerts a forward force of 1600 N on the trailer.

What is the force exerted by the trailer on the tractor?

A 0 N
B 1600 N forwards
C 1600 N backwards
D 3200 N forwards

12. Two blocks X and Y of weight 8.0 N and 2.0 N respectively are suspended by two strings as shown. A downward force of 4.0 N is applied to Y.

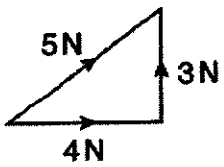


What are the tensions T_1 and T_2 in the two strings?

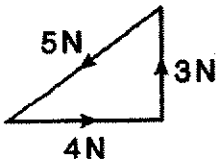
	T_1	T_2
A	8.0 N	22 N
B	10 N	4.0 N
C	14 N	6.0 N
D	12 N	6.0 N

13. Which diagram correctly shows the 3 forces in equilibrium?

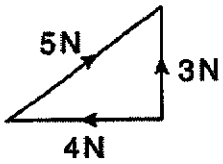
A



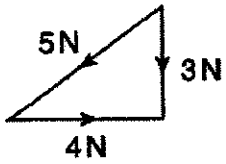
B



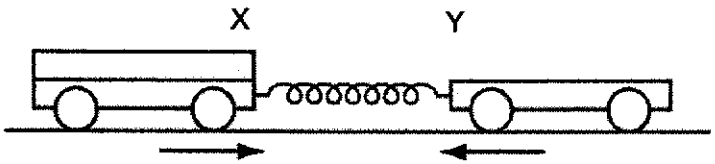
C



D



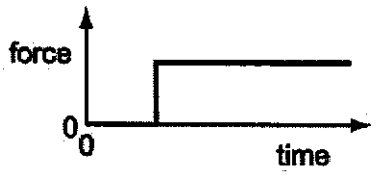
14. Trolley X and trolley Y are joined by a stretched spring. Trolley X has twice the mass of trolley Y.



When the trolleys are released, the acceleration of Y is 2.0 m/s^2 to the left.
What is the initial acceleration of trolley X to the right?

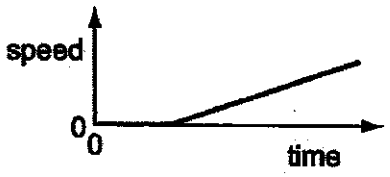
A 1.0 m/s^2 **B** 2.0 m/s^2 **C** 3.0 m/s^2 **D** 4.0 m/s^2

15. A car is stationary at traffic lights. When the traffic lights go green, the driver presses down sharply on the accelerator. The resultant horizontal force acting on the car varies with time as shown.



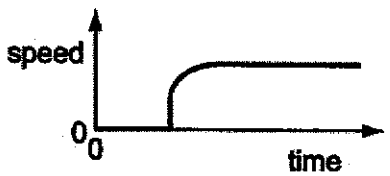
Which graph shows the variation with time of the speed of the car?

A

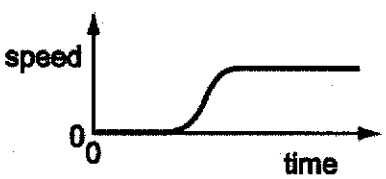


B

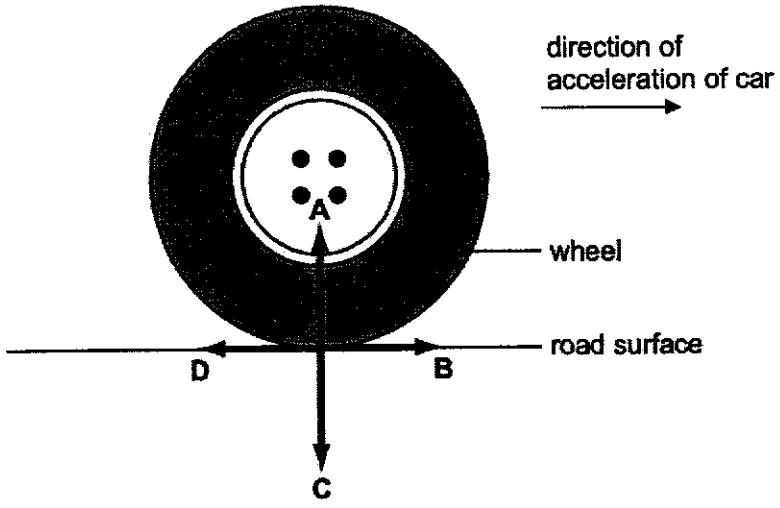
C



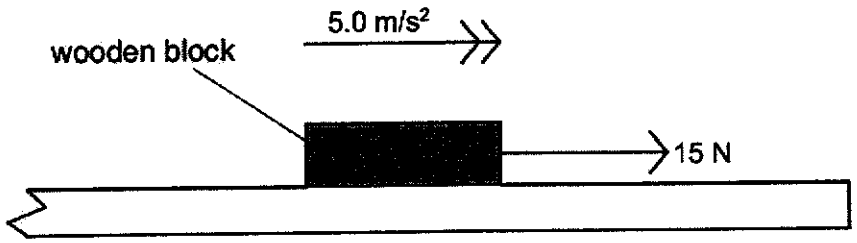
D



16. The wheel of a moving car is driven by the engine. The car is accelerating in the direction shown. In which direction does the frictional force act on the wheel?



17. A wooden block of mass 0.60 kg is on a rough horizontal surface. A force of 15 N is applied to the block and it accelerates at 5.0 m/s^2.



What is the magnitude of the frictional force acting on the block?

A 3.0 N
B 5.0 N
C 12 N
D 18 N

18. A 500 g object has a volume of 100 cm^3. Two holes were drilled in the object. The first hole has a volume of 20 cm^3 and the second hole is half the volume of the first hole. Assume the mass of air to be negligible.

What is the density of the material?

A 5.0 g/cm^3
B 7.1 g/cm^3
C 17 g/cm^3
D 25 g/cm^3

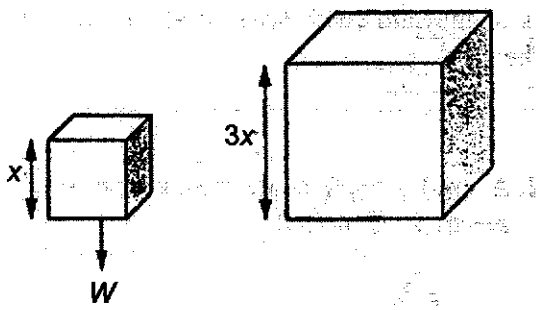
19. The acceleration of free fall on the surface of planet X is one tenth of that on the surface of planet Y.

On the surface of X, a body has a mass of 1.0 kg and a weight of 1.0 N.

What are the mass and the weight of the same body on the surface of planet Y?

	mass on Y/kg	weight on Y/N
A	1.0	0.1
B	1.0	10
C	10	10
D	10	100

20. The diagram shows two cubes made from the same material. One cube has sides that are three times as long as the other cube.



The weight of the small cube is *W*.
What is the weight of the larger cube?

A 3*W*
B 9*W*
C 27*W*
D 81*W*

PASIR RIS CREST SECONDARY SCHOOL
Mid Year Examination
Secondary Three Express

CANDIDATE NAME

CLASS / INDEX NUMBER

PHYSICS

6091/02

Paper 2

14 May 2019

Papers 1 & 2: **1 hour 40 mins**

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Section A and B
Answer **all** questions.

Candidates are reminded that **all** quantitative answers should include appropriate units.
The use of an approved scientific calculator is expected, where appropriate.
Candidates are advised to show all their working in a clear and orderly manner, as more marks are awarded for sound use of Physics than for correct answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

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This document consists of **13** printed pages.

Section A (40 Marks)

1. A student investigates the behaviour of a vibrating spring.

The spring is suspended from a horizontal rod. A mass is hung from the spring.

Fig. 1.1a shows the apparatus when it is not vibrating.

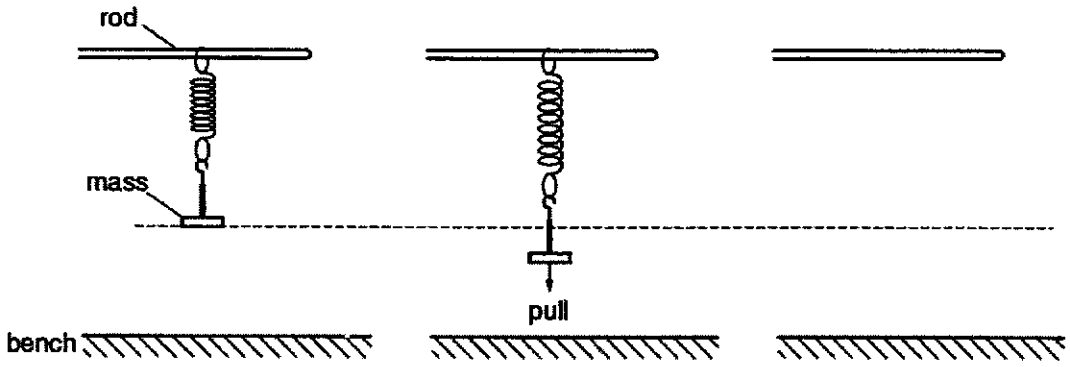


Fig. 1.1a **Fig. 1.1b** **Fig. 1.1c**

The mass is pulled down a small distance, as shown in Fig. 1.1b. When released, the mass vibrates up and down about its original position. The student takes readings to obtain the time *T* for one complete vibration.

(a) On Fig. 1.1c,

(i) draw the mass at its highest position after release, [1]

(ii) mark the most suitable position for the student's eye when the student times the vibrations. [1]

(b) Explain why the mass is pulled down only a small distance before being released. [1]

_____

_____

(c) A student measures the time for the mass to complete 20 vibrations.

Suggest a reason why the student measures the time taken for twenty vibrations rather than one. [1]

_____

_____

(d) When the weight *W* of the mass is 1.0 N, the student times 20 vibrations. This is repeated four times. The following results are obtained.

8.10 s 8.02 s 7.96 s 8.05 s 7.99 s

Calculate the average value of *T*, the time for one complete vibration.

T = _____ [2]

(e) The experiment is repeated for a range of values of *W*.

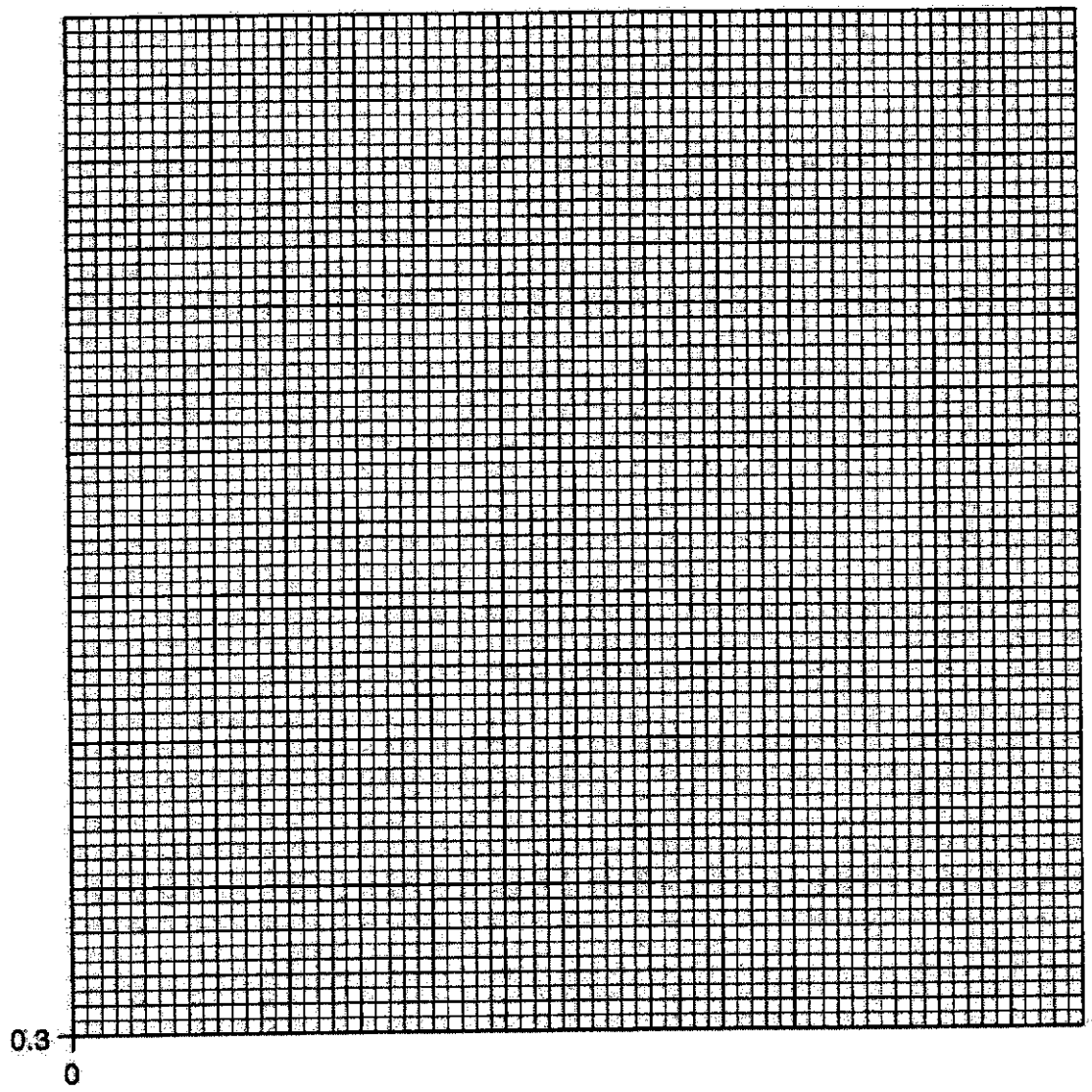
The results are recorded in Fig. 1.2.

W/N	*T*/s
1.0	
2.0	0.565
3.0	0.693
4.0	0.790
5.0	0.895
6.0	0.961

(i) On Fig. 1.2, write your value of *T* for *W* = 1.0 N.

On Fig. 1.3, plot a graph of *T*/s against *W*/N.

Start your axes from *T* = 0.3 s and *W* = 0. Draw a **smooth curve** of best fit.



[4]

Fig. 1.3

(ii) Explain whether you expect the graph to pass through the origin. [1]

(iii) Describe the relationship between T and W. [1]

(iv) Determine the value of T when $W = 5.5$ N

[1]

2. A student is investigating how the size of a piece of paper affects the time taken for it to drop to the ground from a certain height.

Plan an experiment which would enable you to investigate how the size of a piece of paper affects the time taken for it to drop to the ground from a certain height. You are **not** required to carry out the experiment.

The following are some common apparatus which you can use for this investigation:

paper	stopwatch
half-metre rule	retort stand
metre rule	scissors

Write a plan for the experiment.

Your plan should include

- the quantities that you will keep constant,
- a detailed description of how you will perform the investigation,
- a detailed description of how you will process the data collected,
- a statement of the graph that you will plot.

You may draw a diagram if it helps to explain your plan.

[7]

3. Fig 3.1 shows a stone thrown upwards from a point at the edge of a cliff. After the stone has reached its maximum height, it falls past the cliff edge to the beach, as shown.
The effect of air is very small.

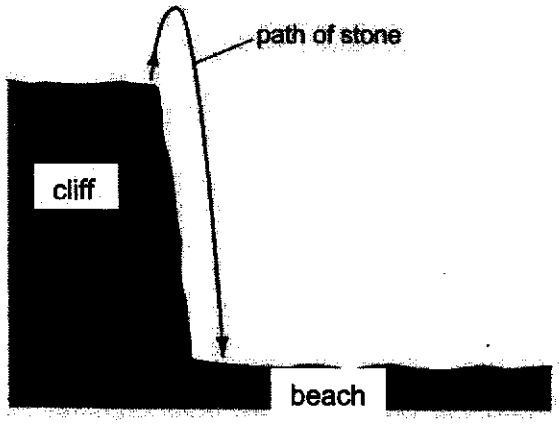


Fig. 3.1

(a) State the initial acceleration experienced by the stone and its direction.

acceleration: [1]

direction: [1]

(b) Explain the difference between speed and velocity.

[2]

(c) The initial velocity of the stone is 10 m/s. The time taken between the stone leaving the edge of the cliff and hitting the beach is 3.2 s.

(i) State the acceleration experienced by the stone at the maximum height and its direction.

acceleration: [1]

direction: [1]

(ii) Sketch a labelled velocity-time graph of the stone for 3.2 s on Fig. 3.2. [2]

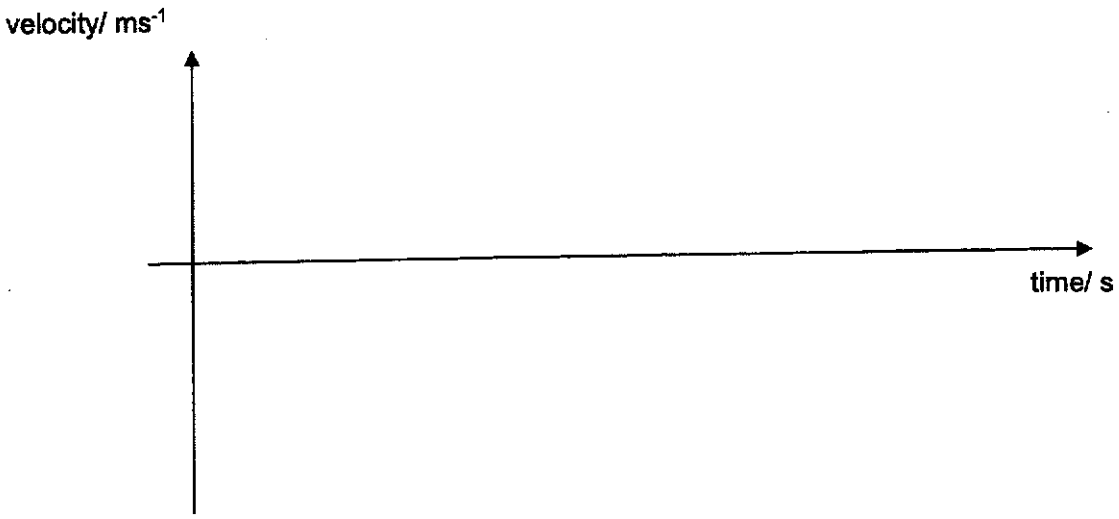


Fig. 3.2

(iii) Calculate the time taken for the stone to reach the maximum height.

time taken = _____ [2]

(iv) Hence, calculate the height of the cliff.

height = _____ [3]

4. A parachutist jumps from an aircraft. Some time later, the parachute opens.

Fig. 4.1 shows a graph of the vertical speed of the parachutist plotted against time *t*.

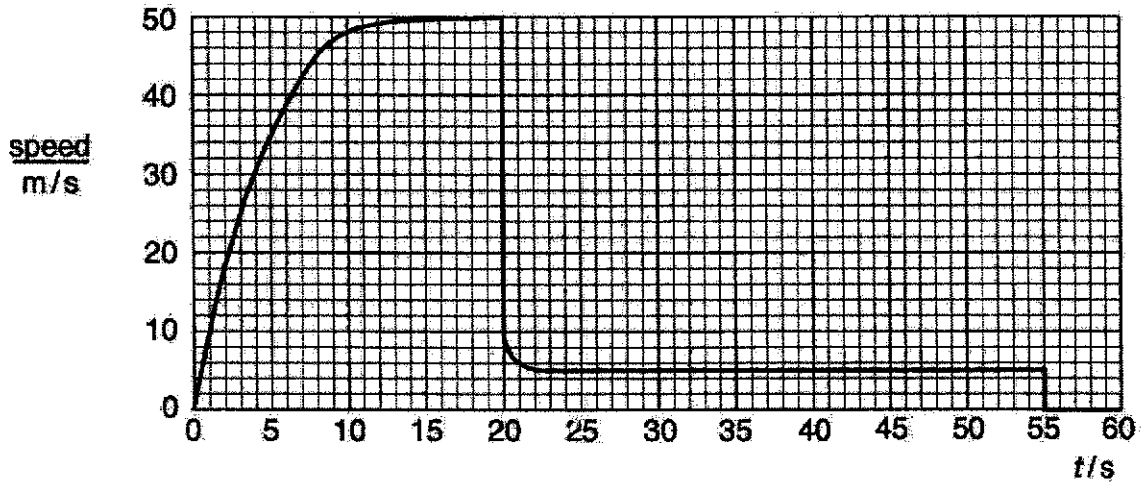


Fig. 4.1

Using Fig. 4.1, explain, in terms of the forces acting, how the acceleration of the parachutist changes between $t = 0$ s and $t = 20$ s.

[4]

5. Fig. 5.1 shows a ball of mass 0.50 kg suspended from the roof of a car with a light inextensible string.

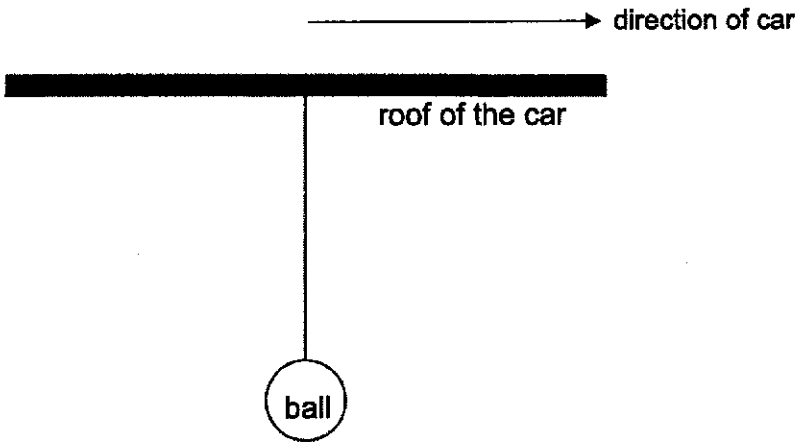


Fig. 5.1

The car is moving to the right with constant speed of 20 m/s.

(a) State what is meant by the term *inertia*.

[1]

(b) Draw on Fig. 5.1, the position of the ball when the car stopped suddenly. [1]

(c) Explain your answer in (b).

[1]

Section B (20 Marks)

6. Fig. 6.1 shows two dogs pulling a stationary sledge along a smooth icy surface.

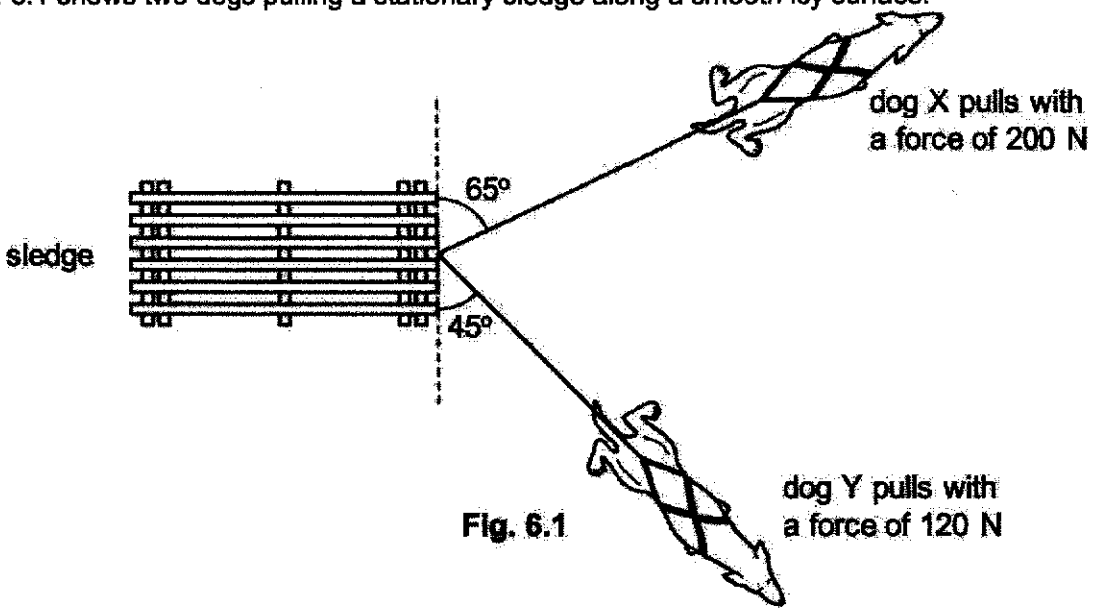


Fig. 6.1

Dog X pulls with a force of 200 N at an angle of 65° to the front edge of the sledge. Dog Y pulls with a force of 120 N at an angle of 45° to the front edge of the sledge.
The mass of the sledge is 150 kg.

(a) (i) In the space below, using a suitable scale, draw a scale drawing to determine the resultant force on the sledge and its direction. State the scale and label the forces of your drawing.

scale: _____

resultant force = _____

direction: _____ [5]

(ii) Calculate the distance that the sledge will travel in 0.50 minutes under this resultant force.

distance = _____ [3]

(b) After moving for 0.50 minutes, the sledge experienced a rough surface with a total resistive force of 100 N.

(i) Determine the new resultant force experienced by the sledge now.

resultant force = _____ [1]

(ii) Explain how the new resultant force affects the motion of the sledge.

_____

[1]

_____

7. A space research organisation plans to send astronauts to Jupiter to examine rocks on its surface. The organisation will produce a report containing information about conditions on Jupiter.

(a) (i) Define *gravitational field strength*.

[1]

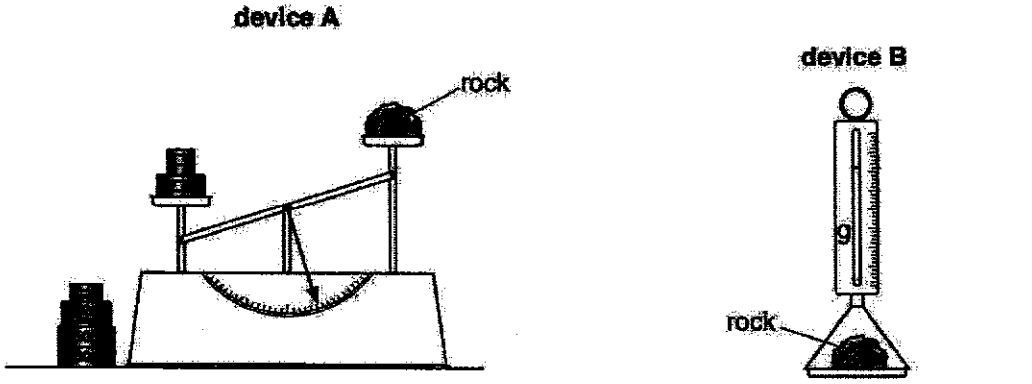
(ii) The astronaut measures the mass of the rock as 500 g and the weight of the rock as 13 N. Calculate the gravitational field strength on Jupiter.

gravitational field strength = _____ [2]

(iii) A rock dropped on Jupiter falls to the surface. State the acceleration of the falling rock. Assume that there is no air resistance on Jupiter.

[1]

(b) While still on the surface of Jupiter, the astronauts will measure the mass of each rock collected. Fig. 7.1 shows two devices for measuring mass.



A lever arm balance and a set of brass discs. The mass of each disc is accurately determined on Earth and the value is marked on it.

A spring balance. The spring balance is accurately calibrated on Earth and the mass values are marked on the vertical scale.

Fig. 7.1

(i) When the two devices are used on Jupiter, they will give different readings for the mass of the same rock. Explain why.

[3]

(ii) State which device will give the correct reading for the mass.

[1]

(c) The astronaut released the rock from a height of 5.0 m above the surface of Jupiter. State and explain how the speed of the rock just before it touches the surface on Earth and Jupiter differ.

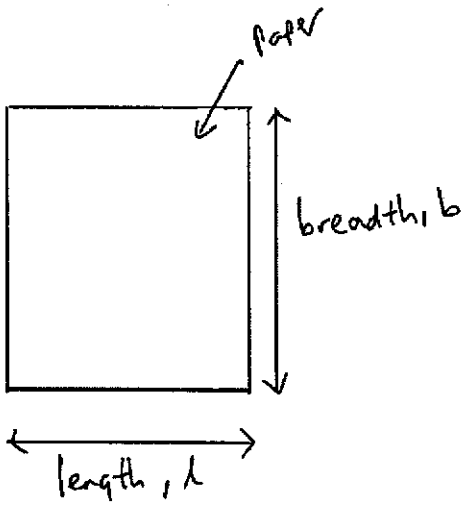
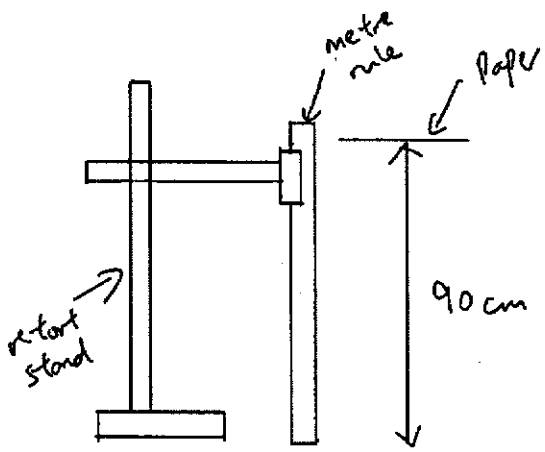
[2]

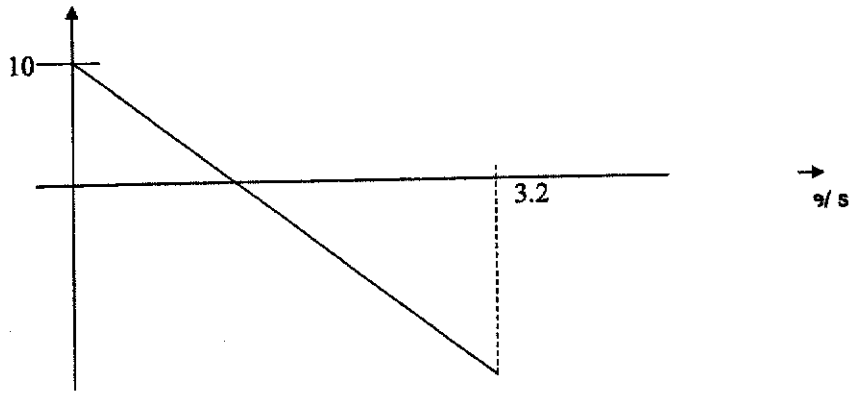
PRCS MYE 2019 3E Physics Solution (Paper 1)

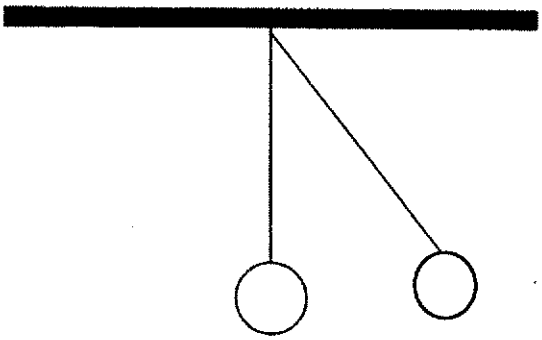
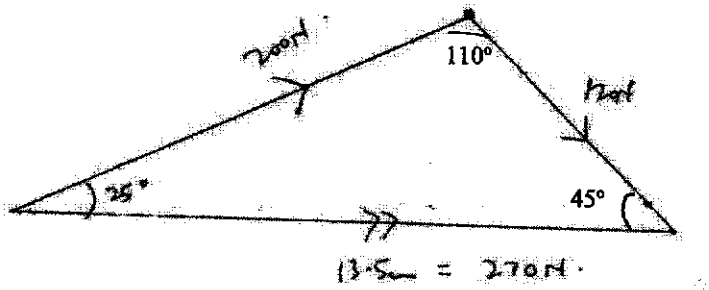
Q1	C	Q6	A	Q11	C	Q16	B
Q2	D	Q7	D	Q12	C	Q17	C
Q3	A	Q8	A	Q13	B	Q18	A
Q4	C	Q9	B	Q14	A	Q19	B
Q5	B	Q10	C	Q15	A	Q20	C

PRCS MYE 2019 3E Physics Worked Solution (Paper 2)

1(a)(i)	point marked above the dotted line: 5.0 cm above	B1
(ii)	eye / E labelled level with dotted line	B1
(b)	within extension of spring/ within elastic limit / not permanently stretched / gives smooth oscillations / load does not jumps off spring / spring does not become slack	B1
(c)	reduces human reaction error (in T)/ Human reaction error is less significant	B1 Human error is not accepted.
(d)	Average time = 8.02 s T = 0.401s	C1 A1
e(i)	axes: correct way round, labelled axis and unit scales: linear, not awkward, more than 1/2 grid e.g. x-axis: 2cm ≡ 1N y-axis: 2cm ≡ 0.1s points plotted accurately neat crosses smooth curve of best fit neatly shown (points within 1 small square)	B1 B1 B1 B1
(ii)	yes + when W = 0 there will be (no extension so) no oscillations	B1
(iii)	non-linear with T increasing as W increases	B1
(iv)	0.92(0) s	B1 (allow ecf)

2	**Variables to be kept constant:** o Initial speed of the paper o Shape of paper o Mass of paper o Orientation of fall o Height of fall **Apparatus:** o Paper o Stopwatch o Half-metre rule o Retort stand o Metre rule o Glue	B2 (At least 2)
	 	
	Procedure 1. Set up the apparatus as shown. 2. **Measure the length, l, and breadth, b, of the paper using the half-metre rule.** 3. **Calculate the surface area of the paper, A = l x b.** 4. **Release the paper from a height of 90 cm.** 5. Using the **stop watch, measure the time taken** for the paper to reach the ground, t. 6. Fold the paper into half and apply the glue to the corner of the paper to secure the paper. 7. Repeat step 2 to 6 for **4 more readings** of the **surface area.** 8. Tabulate the readings for A and t. 9. **Plot a graph of time taken for paper to reach the ground against the surface area of paper.**	B1 B1 B1 (at least 5 reading) B1 B1 – for stating the instruments used to measure time and length

3.(a)	-10 m/s^2 Downwards	CAO1 CAO1
(b)	Speed (is a scalar quantity,) requiring only magnitude Velocity (is a vector quantity,) requiring both magnitude and direction Speed is distance per unit time. Velocity is the displacement per unit time.	B1 B1
(c)(i)	10 m/s^2 Downwards	CAO1 CAO1
(ii)	Velocity/ ms^{-1}  	Correct shape – B1 Negative velocity larger than positive velocity – B1 Minus one for no label.
(iii)	$a = \frac{v-u}{t}$ $-10 = \frac{0-10}{t}$ t = 1.0 s	 B1 B1
(iv)	time taken for the stone to travel from cliff to beach = 3.2 – 1 – 1 = 1.2 s speed just before hitting the beach = 10 (1.2) + 10 = 22 m/s height = ½ (10 + 22) (1.2) height = 19.2 = 19 m	B1 B1 B1
4.	From 0s to 1s: only force acting on the body is **gravitational force**. Thus **acceleration is 10 m/s^2**. From 1s to 15s: As the velocity increases, **the air resistance increases** (and the weight remains constant). **Resultant force decreases**. F = ma. Thus the **acceleration decreases**. From 15s to 20s: **Air resistance is equal to the weight. Resultant force is zero**. Thus the **acceleration becomes zero.** (minus one mark if the timings are wrong)	B1 B1 B1 B1

5(a)	Reluctance of the object to change its state of rest or motion, due to its mass.	B1
(b)		B1
(c)	The ball will continue to move forward due to inertia/mass.	B1
6(a)(i)	Correct shape to determine the resultant force (must have correct angle) Forces are labelled with correct direction  Scale: 1 cm represent 20 N Resultant force = 266 to 274 N (correct answer: 270 N) Direction = 25° from 200 N or 45° from 120 N (± 1°)	B1 B1 B1 B1 B1
(ii)	$acceleration, a = \frac{F}{m} = \frac{270}{150} = 1.8\frac{m}{s^2}$ Velocity after 0.50 min = (0.5 x 60) 1.8 = 54 m/s Distance = ½ (54)(30) = 810 m	B1 B1 B1
(b)(i)	New resultant force = 270 – 100 = 170 N	B1
(ii)	The sledge will move with a **smaller acceleration**.	B1
7.(a)(i)	The gravitational force acting per unit mass.	B1
(ii)	W = mg g = w/m g = 13/0.5 g = 26 N/kg (with correct unit)	 B1 B1
(iii)	26 m/s^2 (allow ecf but unit must be correct)	B1
(b) (i)	A compares/measures (unknown and known) masses/amount of matter B measures/is dependent on weight/ gravitational force and hence mass obtained is incorrect/ Jupiter weights/gravitational force/gravitational field strength are more than/different from (Earth)	B1 B1 B1
(ii)	A	A1
(c)	Speed will be larger in Jupiter. Gravitational field strength/ Accceleration experienced by the rock is larger in Jupiter.	B1 B1 (allow ECF)