Name: .... (   )   Class: ....

ASSUMPTION ENGLISH SCHOOL
MID-YEAR EXAMINATION 2019

SCIENCE (PHYSICS)
5076

LEVEL:	Sec 3 Express / Normal Academic	**DATE:**	16 May 2019
CLASS:	Sec 3/1, 3/2 & 3 NA SBB	**DURATION:**	1 hour 15 minutes

Additional Materials provided: 1 sheet of OAS paper

INSTRUCTIONS TO CANDIDATES
Do not open this booklet until you are told to do so.

Write your NAME and INDEX NUMBER at the top of this page and on the OAS paper.
Shade your index number on the OAS paper.

SECTION A (20 marks)
There are 20 questions in this section. Answer **all** questions. For each question, there are four possible answers A, B, C and D. **Choose the correct answer and record your choice in soft or 2B pencil on the OAS paper provided. DO NOT fold or bend the OAS paper.**

SECTION B (30 marks)
Answer **all** questions. Write your answers in the spaces provided on the question paper.

SECTION C (20 marks)
Answer **any 2** out of 3 questions. Write your answers in the spaces provided on the question paper.

For Examiner's use:	
Section A	/ 20
Section B	/ 30
Section C	/ 20
Total	/ 70

At the end of the examination, hand in your OAS paper and question booklet separately.

This Question Paper consists of 21 printed pages including this page.
[Turn over

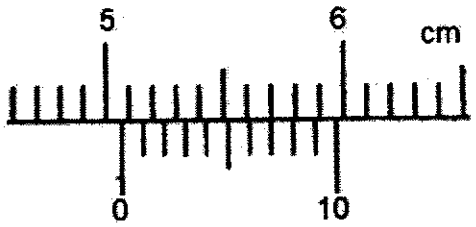
SECTION A: MULTIPLE CHOICE QUESTIONS (20 marks)
Answer **all** questions on the OAS paper provided.

1 Which value has the shortest distance?

A	0.420 Mm	**B**	3.12 dm
C	10.5 μm	**D**	500 nm

2 The diagram below shows the reading on a vernier calliper.

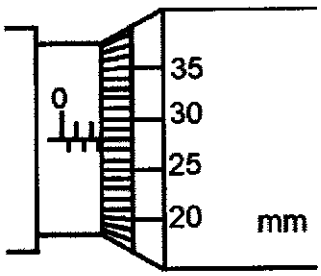
What is the reading shown?



A	5.03 cm	**B**	5.07 cm
C	5.17 cm	**D**	5.70 cm

3 The diagram below shows the reading on a micrometre screw gauge.

What is the reading shown?



A	2.28 mm	**B**	2.78 mm
C	3.28 mm	**D**	5.28 mm

4 Mary feels that her homemade pendulum takes too long to make a complete oscillation.

What can Mary do to correct this issue?

A decrease the length of the pendulum

B decrease the mass of the pendulum

C increase the length of the pendulum

D increase the mass of the pendulum

5 How many different vector quantities are in the formulae?

$$\text{acceleration} = \text{change in velocity} \div \text{time}$$

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

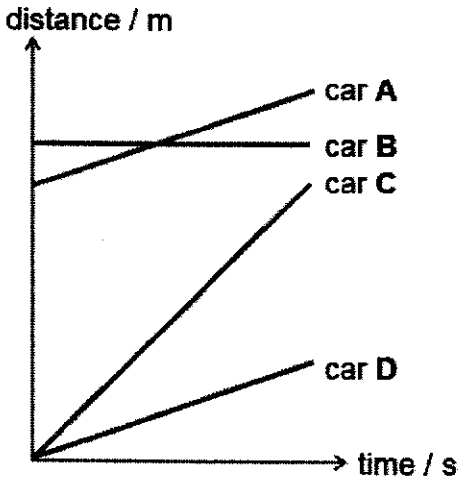
$$\text{moment} = \text{force} \times \text{perpendicular distance}$$

A 2 **B** 3

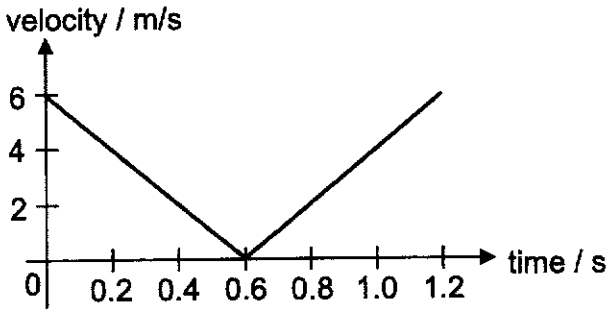
C 4 **D** 5

6 The distance-time graphs of four cars are shown below.

Which car has the greatest average speed?



7 A water-rocket is launched vertically upwards into the air and its velocity-time graph is shown below.

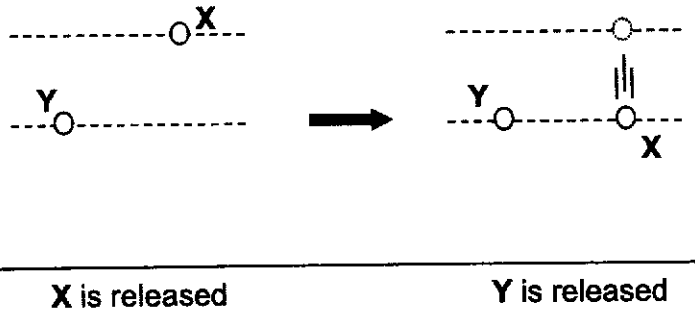


What is the maximum height travelled by the stone?

A 0.6 m **B** 1.8 m

C 3.6 m **D** 7.2 m

8 In the diagram, object **X** is first released from a height, and as it is falling towards the ground, object **Y** is released the instant when both are at the same height.



Assuming air resistance is negligible, which statement is true?

A Both **X** and **Y** will reach the ground together as they have the same acceleration.

B **X** will reach the ground first because it has a greater velocity.

C **Y** will reach the ground first because it has a greater acceleration.

D **Y** will reach the ground first because it has a greater velocity.

9 A ball is released at the top of a building. If the ball takes 4 s to reach the ground, what is the speed of the ball just before it hits the ground and the distance travelled by the ball? The acceleration due to free fall is 10 m/s^2.

	speed / m/s	distance / m
A	2.5	5
B	6	12
C	14	40
D	40	80

10 The total mass of a hot air balloon with some passengers on board is 1500 kg. The balloon rises at a constant speed of 3 m/s. What is the resultant force acting on the balloon when it is rising?

A 0 N **B** 500 N

C 4500 N **D** 15000 N

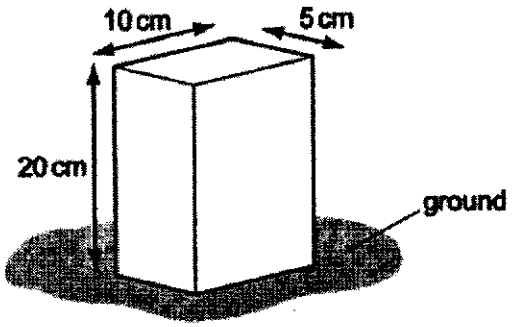
11 A block of mass 25 kg is pushed along a road with a force of 50 N. The frictional force is 10 N.

What is the resultant force and the acceleration of the block?

	resultant force / N	acceleration / m/s^2
A	40 N	0.62
B	40 N	1.6
C	60 N	0.42
D	60 N	2.4

12 A rectangular block that has a weight of 60 N is placed on a flat ground.

What is the **minimum** pressure that it exerts on the ground?



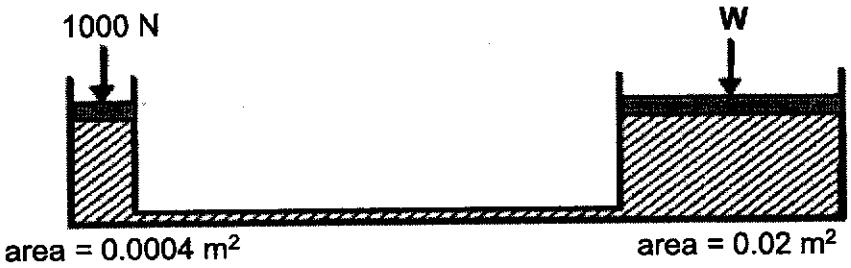
A $\frac{20 \times 5}{60}$ N/cm^2

B $\frac{20 \times 10}{60}$ N/cm^2

C $\frac{60}{5 \times 10}$ N/cm^2

D $\frac{60}{10 \times 20}$ N/cm^2

13 The diagram below shows a hydraulic lift.



What is the maximum weight **W** that can be lifted?

A 20 N

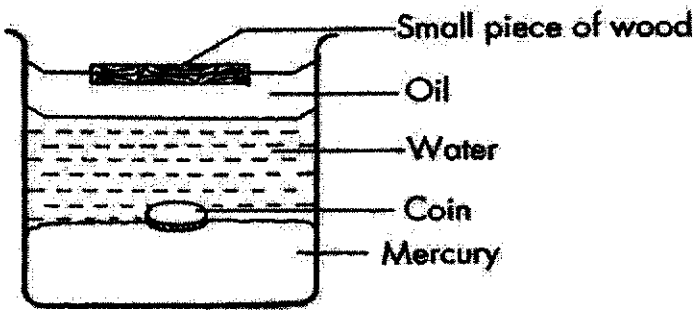
B 500 N

C 50000 N

D 250000 N

14 A student set up the experiment as shown in the diagram below.

What is a correct comparison between the densities of the material or substance?



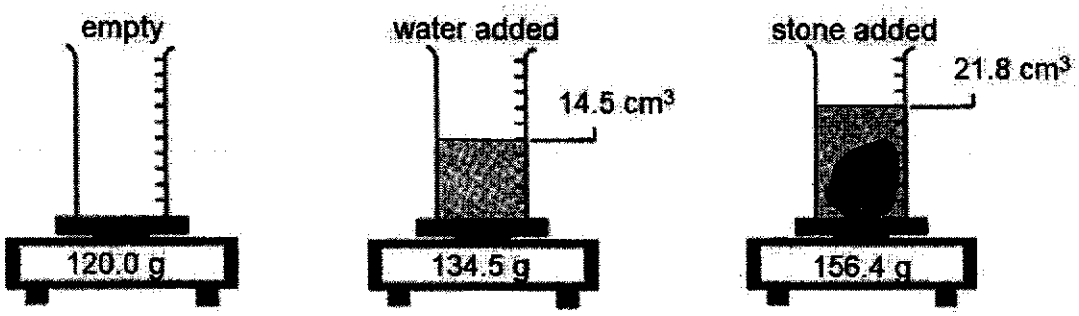
A Coin is less dense than mercury but has the same density as water.

B Oil is less dense than wood but is denser than water, coin and mercury.

C Water is less dense than mercury but denser than oil.

D Wood is the densest among the other materials and substances.

15 To find out the density of a stone, various steps are conducted as shown in the diagram below.



What is the density of the rock?

A 0.995 g/cm³

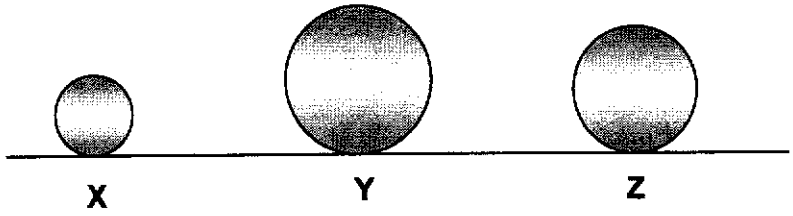
B 3.00 g/cm³

C 4.99 g/cm³

D 7.17 g/cm³

16 A student examines three copper spheres of different sizes.

What can be said about the mass, volume and density of the three spheres?



	mass	volume	density
A	different	different	same
B	different	same	different
C	same	different	same
D	same	same	same

17 What is defined as the centre of gravity of an object?

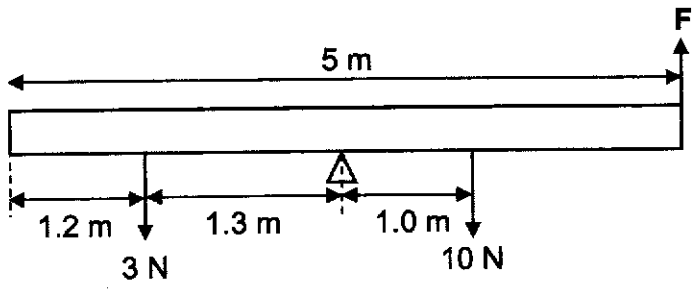
A It is a point where all the weight seems to act on.

B It is a point where all the particles gather at.

C It is a point where density seems to be the greatest.

D It is a point where mass seems to be the heaviest.

18 A 5 m beam is pivoted at its centre. Two loads of 3 N and 10 N are suspended at 1.3 m and 1.0 m away from the pivot respectively.

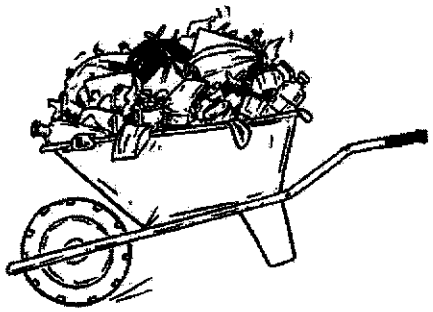


What is the magnitude of upward force **F** needed to keep the beam horizontal?

A 2.44 N **B** 2.56 N

C 3.90 N **D** 7.69 N

19 How does a wheelbarrow help in moving a heavy load?



A The handle is far away from the wheel, creating a moment with a larger force applied.

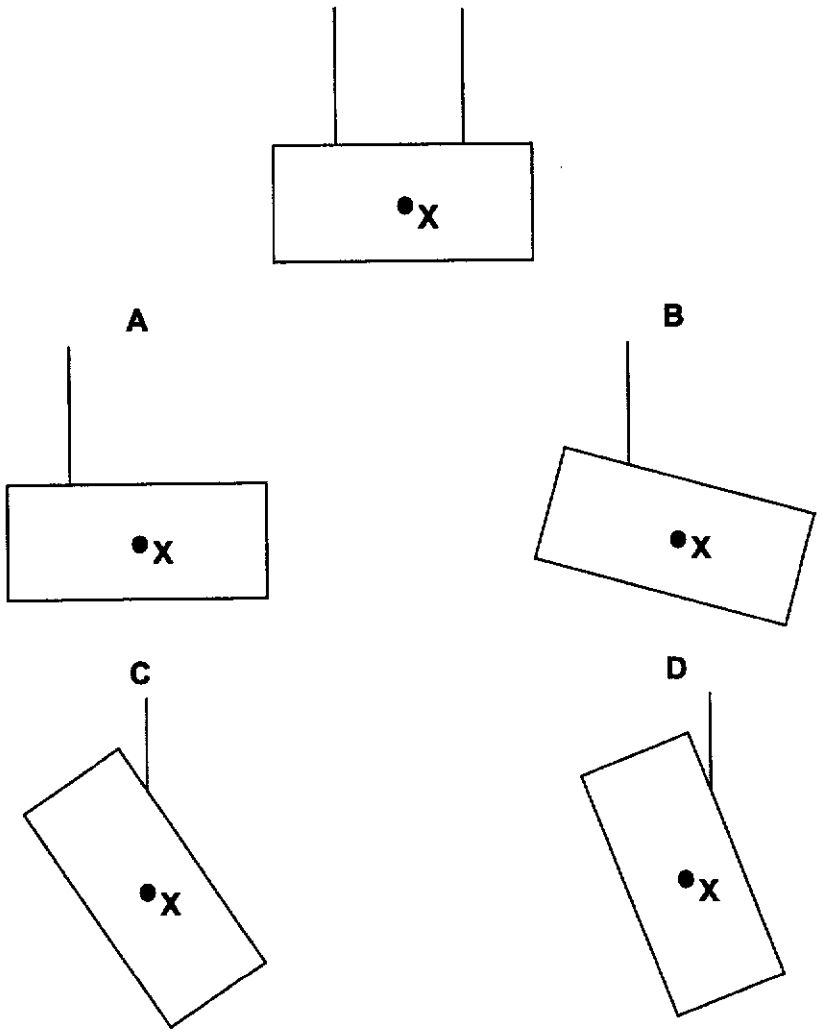
B The handle is far away from the wheel, creating a moment with a smaller force applied.

C The load is nearer to the wheel, creating a larger moment with a larger force applied.

D The load is nearer to the wheel, creating a larger moment with a smaller force applied.

20 A picture frame, with its centre of gravity at **X**, hangs from two strings as shown in the diagram below.

Which diagram shows how the picture frame hangs after one of the strings breaks?



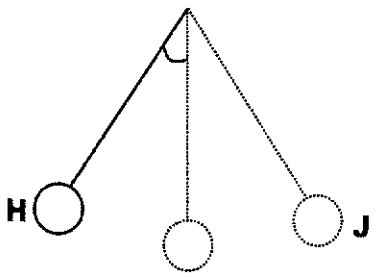
SECTION B: SHORT-STRUCTURED QUESTIONS (30 marks)
Answer **all** the questions in the spaces provided.

1 State the most suitable measuring instruments used for each measurement and write down its precision.

measurement	measuring instrument	precision
depth of a beaker		
length of a glass rod		
thickness of a thin metal plate		

[3]

2 The figure below shows a simple pendulum. The bob of the pendulum was first pulled to position **H** and then released.



(a) Using the diagram above, state what is meant by an *oscillation*.

.....

..... [1]

(b) Define *period*.

.....

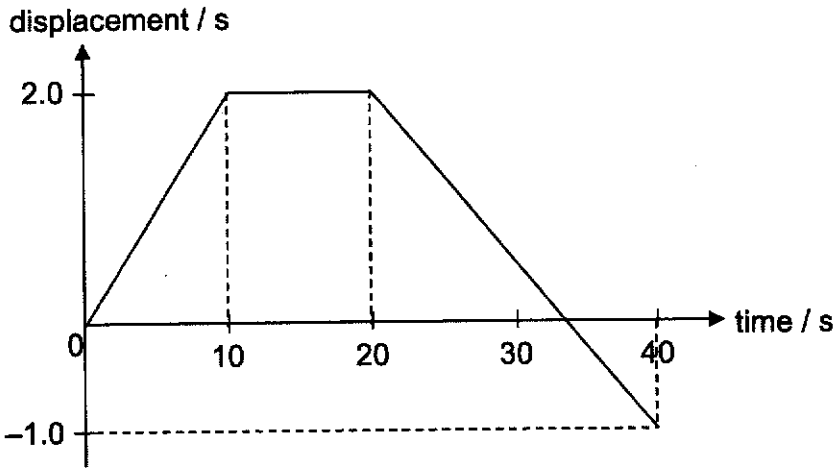
..... [1]

(c) Explain why the angle of oscillation should be kept small.

.....

..... [1]

3 The diagram below shows the displacement-time graph of an object.



(a) State a difference between displacement and distance.

.....

..... [1]

(b) Explain why the displacement is negative at t = 40 s.

.....

..... [1]

(c) Calculate the total distance moved by the object.

total distance = ...m [1]

(d) State what does the gradient of a graph in a displacement-time graph represent.

..... [1]

4 A 5.0 kg box is being pulled by a force of 54 N along a rough surface. It has a rate of acceleration of 2.0 m/s^2.

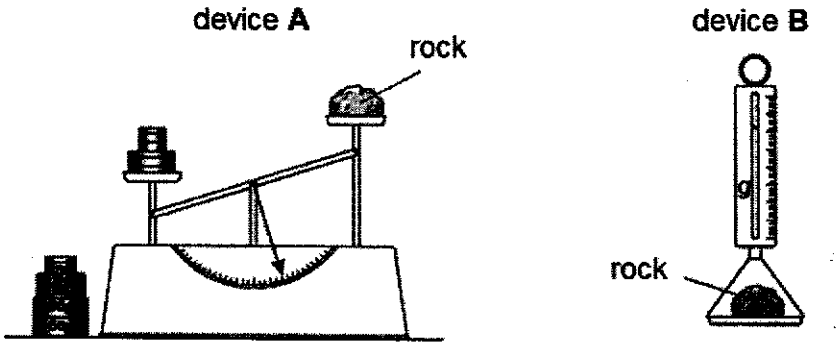
(a) Calculate the resultant force acting on the box.

resultant force = ...N [2]

(b) Determine **F**.

F = ...N [1]

5 An astronaut measures the mass and the weight of a rock on Earth using devices **A** and **B** as shown in the diagram below. The mass of the rock is 0.4 kg.



(a) Identify devices **A** and **B**.

A: ..... balance

B: ..... balance [1]

(b) Calculate the weight of the rock on Earth, given that the gravitational field strength on Earth is 10 N/kg.

weight = ...N [2]

(c) The astronaut brought the same rock to the Moon, where the gravitational field strength is $\frac{1}{6}$ of that on Earth. The mass and the weight of the rock are measured again using devices **A** and **B**.

Explain how the values of the mass and the weight of the rock would change as compared to those taken on Earth.

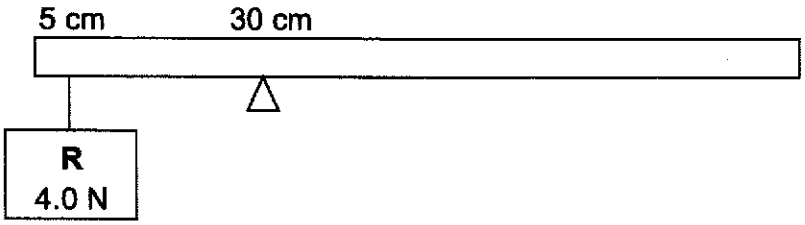
.....

.....

.....

..... [2]

6 The diagram below shows a uniform metre rule pivoted at the 30 cm mark. The rule is balanced by hanging weight **R**, weighing 4.0 N, placed at the 5 cm mark.



(a) State the *principle of moments.*

.....

.....

..... [2]

(b) On the diagram above,

(i) draw an arrow to represent the weight of the metre rule and label it as **W**, [1]

(ii) write down the distance between the pivot and the weight of the metre rule, **W**. [1]

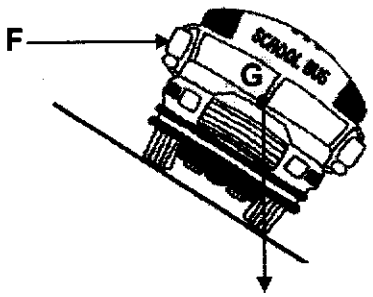
(c) Calculate the weight of the metre rule.

weight = ...N [2]

(d) State what will happen to the metre rule if **R** is moved nearer to the pivot.

..... [1]

7 The figure below shows a bus balancing on a slope, just before it topples over.



(a) State the type of equilibrium the bus is in.

..... [1]

(b) Explain what happens to the bus when a force **F** is applied as shown in the diagram above.

.....

.....

..... [2]

(c) Without changing the size of the bus, suggest and explain another way to improve the stability of the bus.

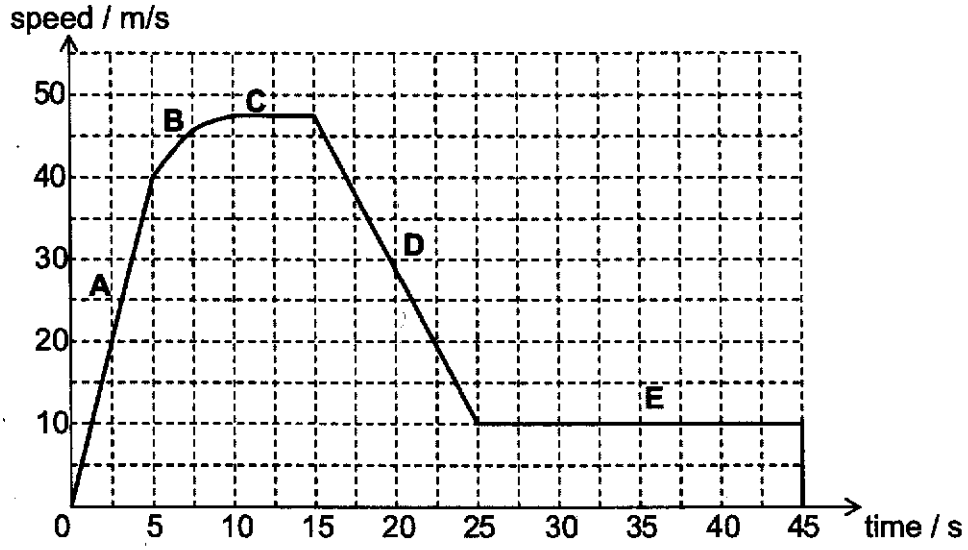
.....

.....

..... [2]

SECTION C: FREE RESPONSE QUESTIONS (20 marks)
Answer **two** out of three questions from this section.

8 The figure below shows how the vertical speed of a parachutist varies with time from the moment he jumps out of the aircraft till he lands on the ground.



(a) State the time at which the parachute opens.

..... [1]

(b) Describe the motion of the parachutist in segments **A** to **C**.

.....

.....

.....

..... [3]

(c) **(i)** Calculate the acceleration of the parachutist in the first 5 seconds.

acceleration = ... [2]

(ii) State a reason why the calculated value in part **(c)** is not equal to the theoretical value of acceleration due to free fall.

..... [1]

(d) The distance travelled by the parachutist is the greatest in segment **C** as compared to segments **D** and **E**.

Discuss whether the statement is true or false.

.....

.....

.....

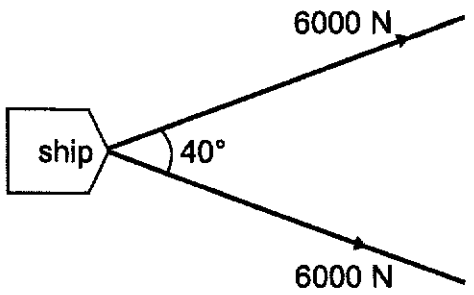
..... [2]

(e) Predict how the graph would change in segment **D** when a bigger parachute is used.

.....

..... [1]

9 A ship is being pulled by two tugs as shown in the diagram below.



(a) The angle between the forces exerted by the two tugs is 40°. Each tug pulls with a force of 6000 N. Draw a scale diagram to determine the resultant force that the tugs exert on the ship.

scale = ...

resultant force = ...

direction = ... [4]

(b) The mass of the ship is 80 000 kg and it moves with a constant speed when pulled by the two tugs.

State the acceleration of the ship and the magnitude of the backward force acting on the ship.

acceleration = ...

backward force = ... [2]

(c) When the two tugs are removed, the ship slows down and eventually comes to a rest.

Calculate the deceleration of the ship, assuming that the backward force is constant.

deceleration = ... [2]

(d) State how the magnitude of the deceleration in part **(c)** would change if

(i) the mass of the ship is smaller, assuming that the backward force is constant,

..... [1]

(ii) the backward force experienced by the ship is smaller.

..... [1]

10 (a) Define *pressure* and state its SI unit.

.....

..... [2]

(b) The African elephant has a mass of 4000 kg and stands on all four feet, each of area 200 cm^2. The gravitational field strength is 10 N/kg.

(i) Convert 200 cm^2 to m^2.

200 cm^2 = ...m^2 [2]

(ii) Calculate the pressure, in Pa, exerted on the ground by the elephant.

pressure = ...Pa [2]

(c) Explain how the pressure exerted on the ground by the elephant would change if it stands up with just two feet.

.....

.....

..... [2]

(d) Explain why it is advisable for a human to run in a zig zag manner when chased by an elephant.

.....

.....

..... [2]

– End of Paper –

Sec 3 Express Mid-Year Examination 2019
Science (Physics) 5076
Answer Keys and Marking Scheme

SECTION A – 20 M

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

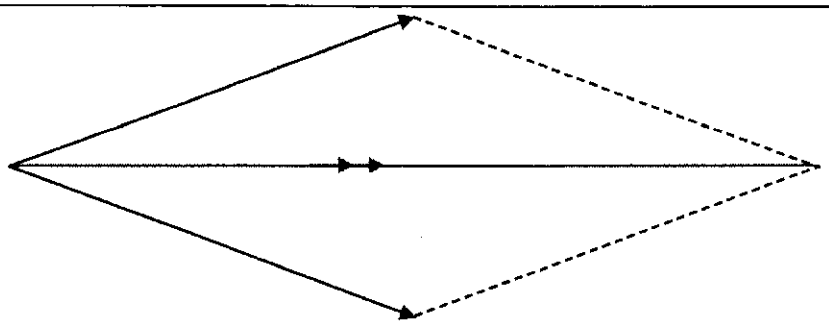
SECTION B – 30 M

1	<table><tr><th>measurement</th><th>measuring instrument</th><th>precision</th></tr><tr><td>depth of a beaker</td><td>vernier calipers</td><td>0.01 cm</td></tr><tr><td>length of a glass rod</td><td>metre rule / measuring tape</td><td>0.1 cm</td></tr><tr><td>thickness of a thin metal plate</td><td>micrometre screw gauge</td><td>0.01 mm</td></tr></table> 1 pair – 1 mark	B3
2a	An oscillation is where the bob swings **from H to J and back to H** again.	B1
2b	A period is the time taken to make a complete oscillation.	B1
2c	To **reduce air resistance** so that the **period will be more accurate.**	B1
3a	Displacement is a **vector** while distance is a **scalar** / Displacement involves **direction** while distance has **no direction.**	B1
3b	It is negative because the object is moving **behind** the starting position.	B1
3c	3.0 m	B1
3d	Velocity	B1
4a	$F_R = 5.0(2.0)$ $= 10N$	M1 A1
4b	$54 - F = 10$ $F = 44N$ Ecf from 4a.	B1
5a	A: beam balance B: spring balance	B1

5b	$W = 0.4(10)$ $= 4N$	M1 A1
5c	On the moon, the mass remains the same as it does not depend on gravitational field strength. However, weight decreases as gravitational field strength decreases.	B1 B1
6a	For an object to be in equilibrium, **the sum of anticlockwise moment must be equal to the sum of clockwise moment** about the **same pivot.**	B1 B1
6bi	Centre of the metre rule, pointing downward	B1
6bii	20 cm	B1
6c	$W(20) = 4.0(25)$ $W = 5N$ Ecf from 6bii.	M1 A1
6d	The metre rule will rotate clockwise.	B1
7a	Unstable equilibrium	B1
7b	The bus will **topple down in a clockwise direction** because the **centre of gravity lies beyond the base** of the bus.	B1 B1
7c	Add more mass to the bottom of the bus to lower the centre of gravity.	B1 B1

SECTION C – 20 M

8a	15 s	B1
8b	At A, the object is moving with constant acceleration. At B, the object is moving with decreasing acceleration. At C, the object is moving with constant velocity.	B1 B1 B1
8ci	$a = \frac{40-0}{5}$ $= 8m/s^2$	M1 A1
8cii	There is air resistance.	B1
8d	The distance travelled in segment D is the **largest** among C and E because it has the **largest area under graph.** However, distance travelled in C is **larger than E** because its **area is larger.** Therefore the statement is not true.	B1 B1
8e	The graph will become steeper as the air resistance will be greater.	B1

9a	 - appropriate scale - correct diagram - resultant force between 11200 N to 11300 N (actual ~ 11276 N) - 20° anticlockwise from 6000 N / 20° clockwise from 6000 N Deduct 1 mark if arrows are not drawn.	 B1 B1 B1 B1
9b	0 m/s^2 Backward force = same as part (a)	B1 B1
9c	$11250 = 80000a$ $a = 0.141 m/s^2$ Ecf from 9b.	M1 A1
9di	Larger deceleration	B1
9dii	Smaller deceleration	B1
10a	Pressure is defined as the force acting per unit area. The SI unit is pascal / Pa.	B1 B1
10bi	$200cm^2 = 200 \div 10000$ $= 0.02m^2$	M1 A1
10bii	$P = \frac{40000}{0.02 \times 4}$ $= 500000Pa$ Ecf from 10bi.	M1 A1
10c	The contact area will decrease, leading to a greater pressure as the weight of the elephant is the same.	B1 B1
10d	The mass of the elephant is large, hence it has a higher inertia. By running in a zig zag manner, the elephant is unable to make change its direction easily due to high inertia.	B1 B1