Name: _____ ( ) Class: _____

WOODLANDS SECONDARY SCHOOL
TERM 2 WEIGHTED ASSESSMENT 2019

Level:	Sec 3 Express	Marks:	45
Subject:	Physics	Day:	Monday
Paper:	6091	Date:	13 May 2019
Duration:	1 hour	Time:	1235 - 1335

READ THESE INSTRUCTIONS FIRST

Write your name, register number, class and date in the spaces provided.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Be neat and show all working and answers clearly.
Marks will be deducted for untidy work and missing working.

Section A: Answer **all** questions. Write your answers in the table provided.
Section B: Answer **all** questions in the spaces provided.

The number of marks is given in brackets [ ] at the end of each question or part question.

FOR EXAMINER'S USE	
Section A	/15
Section B	/30
Total	/45

DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO.
This document consists of **13** printed pages and **1** blank page.

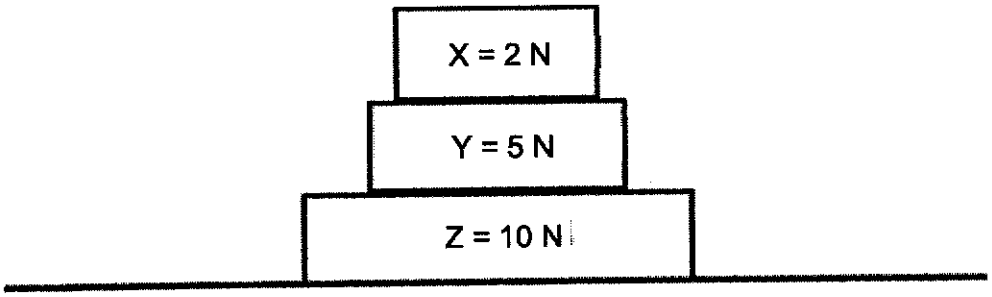
Section A: Multiple Choice Questions (15 marks)

Answer **all** questions. Write your answers in the table provided.

1	2	3	4	5	6	7	8	9	10

11	12	13	14	15

1 Three boxes X, Y and Z are resting on the floor as shown in the diagram below. The weights of the boxes are 2 N, 5 N and 10 N respectively.



What is the resultant force acting on box Z?

A 0 N **B** 5 N **C** 7 N **D** 17 N

2 A 2 kg steel ball sinks downward at a constant speed of 5 m/s for 10 seconds.

What is the resultant force acting on the submarine during this period?

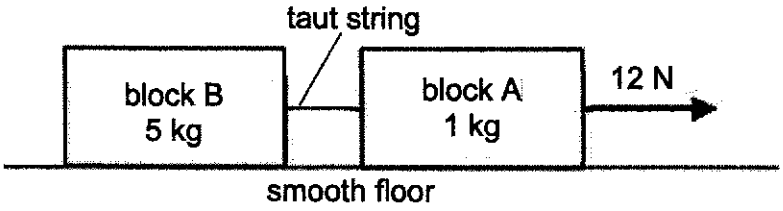
A 0 N **B** 0.5 N **C** 1.0 N **D** 10 N

3 A woman pushes a trolley of mass 3 kg along a rough horizontal surface by exerting a horizontal force of 20 N on it. The trolley accelerates at a rate of 5 m/s^2.

What is the frictional force acting on the trolley as it is being pushed along the surface?

A 0 N **B** 5 N **C** 15 N **D** 20 N

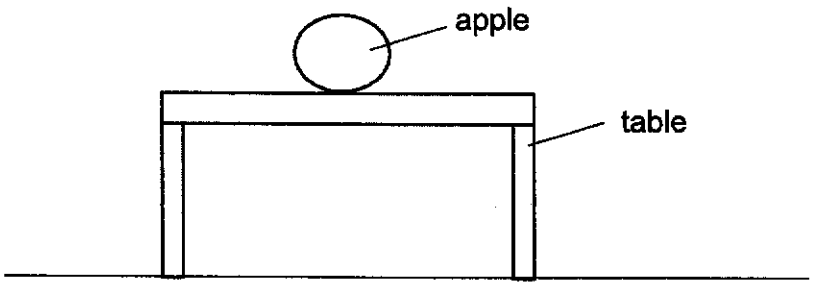
4 A 12 N force acts on block A, as shown, pulling blocks A and B to the right along a smooth floor. Blocks A and B have masses of 1 kg and 5 kg, respectively, and are connected by a taut string.



Given that both blocks accelerate at 2 m/s^2, what is the tension of the string between blocks A and B?

A 0 N **B** 2 N **C** 10 N **D** 12 N

5 An apple is resting on a table, as shown.



Which of the following are action-reaction pairs?

	Action force	Reaction force
A	gravitational force acting on the apple by Earth	gravitational force acting on the table by Earth
B	gravitational force acting on the apple by Earth	normal contact force acting on the apple by the table
C	normal contact force acting on the apple by the table	normal contact force acting on the table by the apple
D	normal contact force acting on the table by the apple	gravitational force acting on the table by Earth

6 Four astronauts, P, Q, R and S landed on several planets. From the information below, which two astronauts most likely landed on the same planet?

astronaut	mass / kg	weight / N
P	50	100
Q	50	250
R	70	140
S	70	250

A P and Q
B P and R
C Q and R
D Q and S

7 A pail on Earth is filled with sand and suspended using a long rope. The suspended pail is then given a push. This experiment is repeated on the Moon, which has a gravitational field strength six times weaker than that of Earth's.

Which statement best explains the observation made?

A A larger force is required to move the pail on Earth than on the Moon.
B A larger force is required to move the pail on Moon than on the Earth.
C The same amount of force is needed to move the pail in both cases.
D The pail on Earth will be moved, but the pail on the Moon remains stationary.

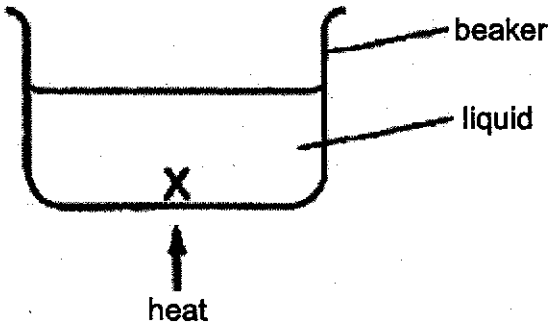
8 The following table shows the result of an experiment in which a sample of solid material is placed in four different liquids.

liquid	density of liquid/ kg m^{-3}	observation
organic compound	550	solid sample sinks
turpentine	700	solid sample sinks
water	1000	solid sample floats
mercury	13600	solid sample floats

Which describes the density of the solid sample most accurately?

A exactly 700 kg m^{-3}
B exactly 1000 kg m^{-3}
C between 700 kg m^{-3} and 1000 kg m^{-3}
D between 1000 kg m^{-3} and 13600 kg m^{-3}

9 Some liquid in a beaker is heated, causing the liquid at region X to expand.



What happens to the mass and density of the liquid at region X?

	mass	density
A	decreases	increases
B	increases	stays the same
C	stays the same	decreases
D	stays the same	increases

10 Figure X shows a lady driving without a safety seat belt. In the event of a collision with another car, the lady would appear to be thrown forward as shown in Figure Y.

Fig. X

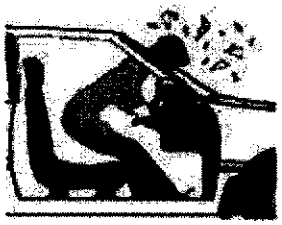


Fig. Y

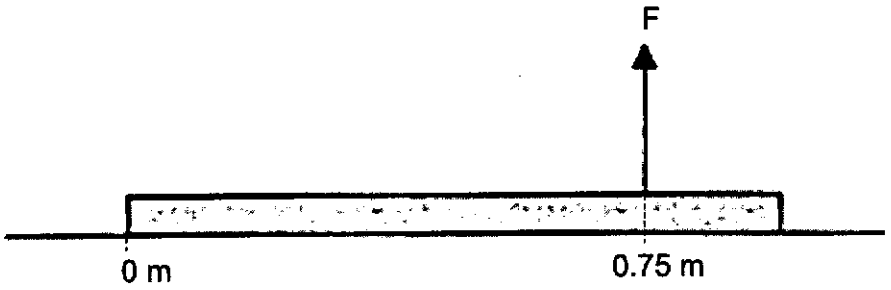
Why would she appear to be thrown forward?

A The car stops but she continues to move forward.
B The car takes some time to come to rest.
C The seat pushes her forward.
D The steering wheel pulls her forward.

11 Which statement correctly describes the principle of moments?

A All moments about the same point are equal for a system in equilibrium.
B The moment of a force is equal to the product of the force and the perpendicular distance between the line of action of the force and the pivot.
C The moment of a force is equal to the product of the force and the perpendicular distance between the line of action of the force and the pivot only for a system in equilibrium.
D The sum of clockwise moments about a point is equal to the sum of anticlockwise moments about the same point only for a system in equilibrium.

12 A 1.0 m long uniform beam weighing 3.0 N is being lifted vertically by a force F at the 0.75 m mark.

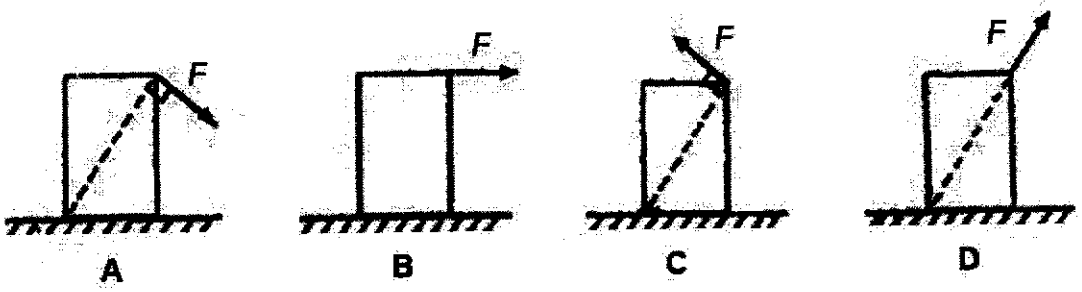


What is the minimum force required to do so?

A 2.0 N
B 3.0 N
C 4.0 N
D 6.0 N

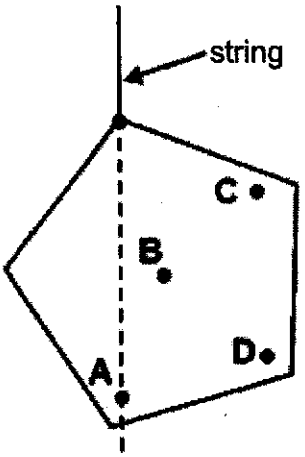
13 A uniform rectangular block rests on a surface and a force *F* is applied to the block.

Which of the following shows the easiest way for the force *F* to topple the block?

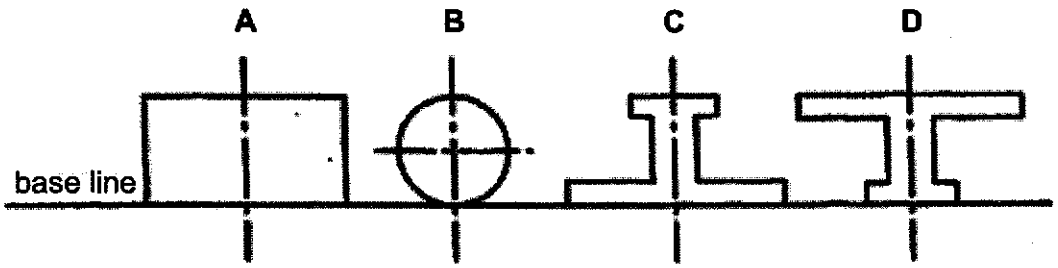


14 The diagram below shows a piece of lamina freely suspended from a string, with no other external forces acting on it except for the weight of the lamina. The lamina does not have a uniform density.

Which position (A, B, C or D) is its most probable centre of gravity?



15 The diagram shows four shapes, cut from the same piece of card.
Which shape has its centre of gravity closest to the base line?



Section B (30 marks)
Answer **all** questions in the spaces provided

1 A block is placed on a smooth slope.

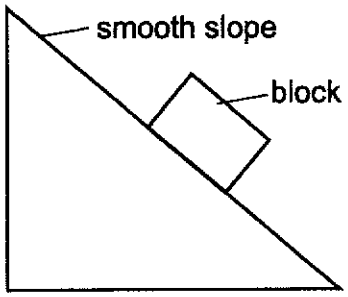


Fig. 1.1

Draw arrows, on Fig. 1.1, to indicate the forces acting on the block.
Label the names of all the forces. Show all construction lines. [2]

2 A 0.5 N helium-filled balloon is held at a fixed height from the ground with a taut string, as shown in Fig. 2.1. The helium-filled balloon experiences a vertically upward lift force of 2.5 N.

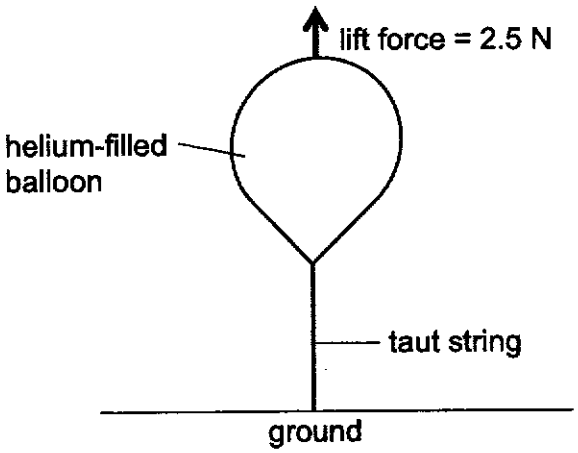


Fig. 2.1

(a) Draw an arrow, on Fig. 2.1, to indicate the direction of tension acting on the helium-filled balloon. [1]

(b) Given that the balloon is in equilibrium, calculate the tension acting along the taut string.

tension = ... [1]

2 **(c)** The string is cut at $t = 0$ s.

Calculate

(i) the resultant force acting on the helium-filled balloon at $t = 0$ s,

resultant force = ... [1]

(ii) the acceleration acting on the helium-filled balloon at $t = 0$ s.

acceleration = ... [2]

(d) Describe and explain, in terms of the forces acting on the helium-filled balloon, how the acceleration of the balloon would change after the string is cut.

.....

.....

.....

..... [2]

3 Describe in detail, with the aid of a diagram(s) in the space provided, how a student can accurately determine the density of a small irregularly-shaped stone with common laboratory apparatus. You may assume that the stone sinks in water.

.....

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.....

.....

..... [4]

4 Brass is a metal alloy comprising of copper and zinc metals. 50 cm^3 of copper is mixed with 20 cm^3 of zinc to form a Brass sample. The densities of copper and zinc are 8.96 g/cm^3 and 7.13 g/cm^3, respectively.

(a) Calculate the density of the Brass sample.

density = ... [3]

(b) State the density of the Brass sample if it were cut in half.

density = ... [1]

5 Two trucks, 9 000 kg and 5 000 kg, both collide with each other head-on as shown in Fig. 5.1.

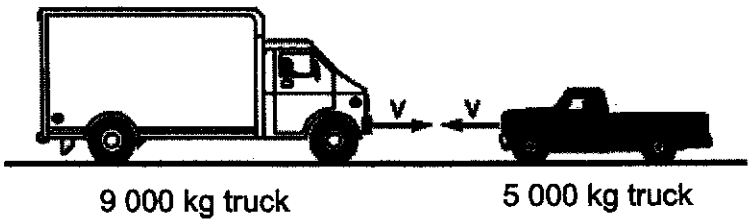

Fig. 5.1

Both trucks experience an acceleration in the reverse direction upon colliding with each other.

Given that the friction acting on both vehicles are equal, state and explain which truck experiences a greater acceleration upon colliding with each other.

.....

.....

..... [2]

6 A bottle filled to the neck with water rests on the floor, as shown in Fig. 6.1 (a). The bottle is tilted slightly and released, as shown in Fig. 6.1 (b).

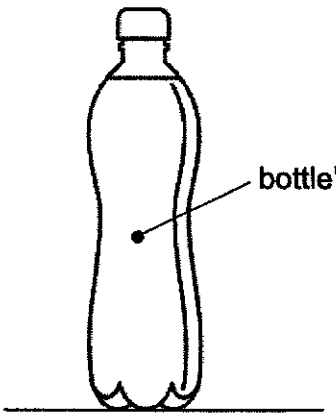

Fig. 6.1 (a)

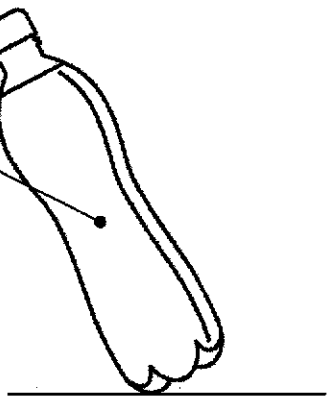

Fig. 6.1 (b)

(a) Draw, in Fig. 6.1(b), the weight vector acting on the bottle. [1]

(b) Draw, in Fig. 6.1(b), a 'X' to label the point about which the bottle is pivoted. [1]

6 **(c)** State and explain whether the bottle will topple to its side.

.....

..... [1]

(d) Suggest two changes you could make to the design of the bottle to increase its stability.

1. .....

.....

2. .....

.....[2]

7 A plank of negligible mass rests on pivots X and Y. A 15 N steel ball rests on the plank 0.4 m away from pivot Y, as shown in Fig. 7.1. The entire system in Fig. 7.1 is in equilibrium.

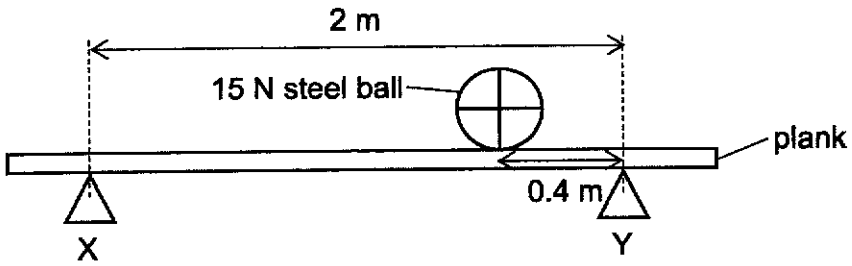

Fig. 7.1

(a) Using the Principle of Moments, calculate the upward force that pivot X exerts on the plank.

force due to X = ... [3]

7 **(b)** Hence, or otherwise, calculate the upward force that pivot Y exerts on the plank.

force due to Y = ... [2]

(c) Describe how the magnitude of the force acting on the plank due to pivots X and Y would change as the steel ball is moved slightly to the left along the plank.

Pivot X: .....

Pivot Y: .....[1]

END OF PAPER

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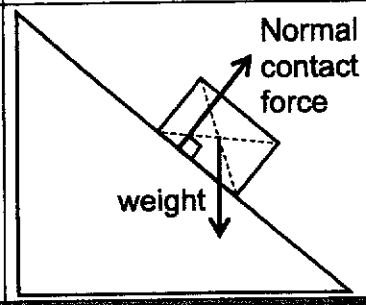
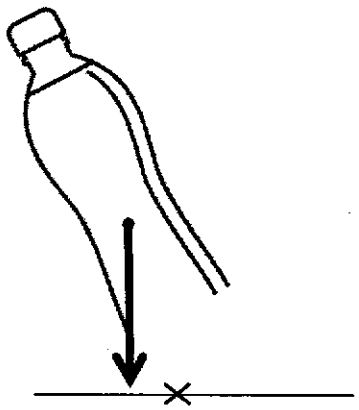
Marking Scheme for 3Exp Pure Physics WA2 2019

Section A: [15 Marks]

1	A	**6**	B	**11**	D
2	A	**7**	C	**12**	A
3	B	**8**	C	**13**	C
4	C	**9**	C	**14**	A
5	C	**10**	A	**15**	C

Section B (30 marks):

Qn	Answer	Mark	Remarks
1		B1	award mark for weight vector
		B1	award mark for Normal contact force vector
[redacted]			
3	Pour some water into a measuring cylinder and record its volume. Submerge the stone in the measuring cylinder. Record the new volume. Subtract both readings to determine the volume of the stone using a measuring cylinder.	B1	o.e.
	Use an electronic mass balance to determine the mass of the stone.	B1	o.e.
	Determine the density of the stone by dividing the mass of the stone by its volume, $\rho = \frac{m}{V}$	B1	o.e.

	(Diagram showing how the volume of the stone is obtained using either a displacement can or a measuring cylinder.)	B1	o.e.
[redacted]	[redacted]	[redacted]	
5	The 5000 kg truck will experience a greater acceleration.	B1	
	The resultant force acting on both trucks are the same. Since $F_R = ma$, the truck will the smaller mass will experience the greater acceleration.	B1	
[redacted]	 Fig. 6.1 (b)	[redacted]	[redacted]
7a	(calculation of CW OR ACW moments shown) $2 \times F_X$ OR OR 0.4×15	M1	
	By the Principle of Moments, Taking moments about Y, $M_{CW} = M_{ACW}$ $1.6 \times 15 = 2 \times F_Y$	M1	
	$F_X = 12$ N	A1	
7b	Upward Forces = Downward forces $12 + F_Y = 15$ OR By the Principle of Moments, Taking moments about Y, $M_{CW} = M_{ACW}$ $2 \times F_X = 0.4 \times 15$	M1	(o.e.) e.c.f. from (a)

	F_Y = 3 N	A1	
7c	The force due to X would increase, while the force due to Y would decrease.	B1	

Note:

1. Minus 1M from the whole paper for mistakes in fraction/unit
2. Minus 1M from the whole paper for mistakes in sig. fig. (accept 2 s.f. and 3.s.f as final ans)

(For 1 and 2, write down the no. of occurrences on the cover page)