Class	Register Number	Name

南洋女子中学校

NANYANG GIRLS' HIGH SCHOOL

Mid-Year Examination 2017
Secondary Three

ADVANCED PHYSICS

Sections B & C **1 hour 30 minutes**

Thursday **11 May 2017** **08:45 – 10:15**

Calculators may be used

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.
Write your name, register number and class in the spaces at the top of this page and on any separate answer paper used.

Section A (20 marks)
Printed in a separate document.

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

Section C (10 marks)
Answer the **free-response** question in the spaces provided on the question paper.

INFORMATION FOR CANDIDATES
The intended number of marks is given in the brackets [ ] at the end of each question or part question. You are advised to spend no longer than 30 minutes on Section A and no longer than 1 hour on Sections B and C.

You are reminded that all quantitative answers should include appropriate units. You are advised to show all your working in a clear and orderly manner, as more marks are awarded for sound use of Physics than for correct answers.

The use of an approved scientific calculator is expected, where appropriate.

Take the acceleration due to gravity to be 10 m s^{-2} or gravitational field strength to be 10 N kg^{-1}.

Examiner's Use	
Section A	
Section B	
21	
22	
23	
24	
25	
26	
27	
Section C	
28	
Total	
	60
	%

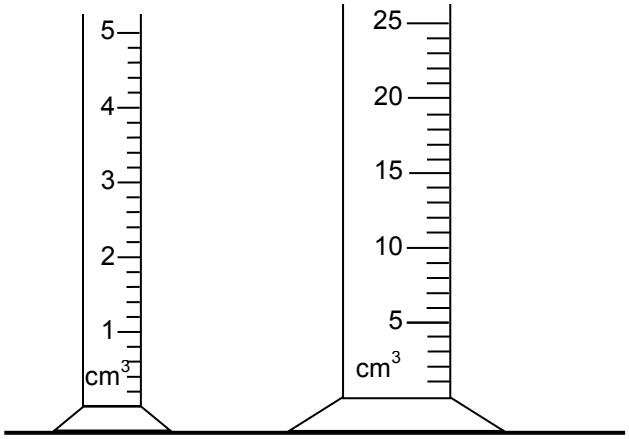
Section B (30 marks)

Write your answers in the spaces provided.

21 The following experiments were conducted to determine the volume of a marble.

1. Measuring cylinder A was filled with some water and the measuring cylinder reading V_i was recorded.
2. A marble was placed into A such that it was fully submerged and the new measuring cylinder reading V_f was recorded.
3. The volume of the marble was determined from $V_f - V_i$.
4. Steps 1 to 3 were repeated with measuring cylinder B.

The diagrams below show measuring cylinders A and B.



(a) Identify the measuring cylinder with the higher precision and state its precision.

The measuring cylinder with the higher precision is …….

The precision of the measuring cylinder is …… [1]

(b) The volume of the marble was found to be slightly more than 2 cm^3. The experiment was repeated by placing 5 similar marbles into a measuring cylinder to determine the total volume V_T of the 5 marbles. The average volume was then calculated from $V_T \div 5$.

(i) Suggest which measuring cylinder should be used and the reason for your choice.

Measuring cylinder to be used is …….

Reason for your choice: ……..

……..

…… [1]

(ii) Give **two** reasons why using 5 marbles is a better method for determining the volume of a marble.
Reason 1:

……

……

……

…… [2]

Reason 2:

……

……

……

…… [2]

22 A marble is released from the top of a straight track as shown in Fig. 22.1 and the distance travelled from the start position, d, is recorded at regular time intervals.

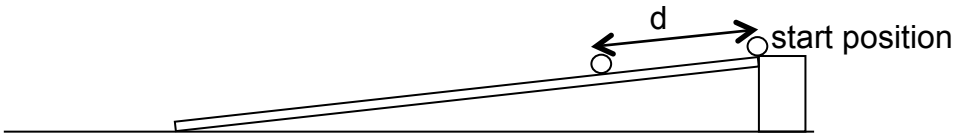


Fig. 22.1

The results are shown in the table below.

time / s	0.00	0.40	0.80	1.20	1.60	2.00
d / cm	0.0	10.0	25.0	45.0	70.0	100.0

(a) Calculate the average speed of the marble down the slope.

average speed of the marble = …… [1]

(b) Describe the acceleration of the marble down the slope. Show the working for any calculation done to support your description in the space below.

……

……

Working:

[3]

23 The velocity-time graph of a car travelling along a straight road is shown in Fig. 23.1.

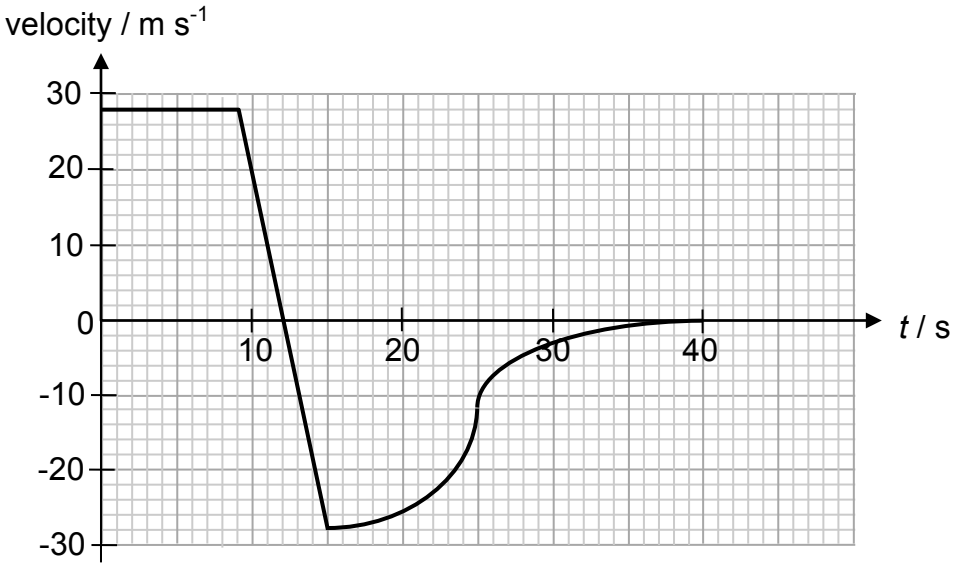


Fig. 23.1

(a) Describe the motion of the car from t = 0 s to t = 15 s.

……

……

……

……

……

……

……

…… [3]

(b) Calculate the displacement between t = 0 s to t = 15 s.

displacement = ……[2]

24 Fig. 24.1 shows a section of a ticker tape pulled by trolley T through a ticker timer to the right. The frequency of the ticker timer is 50 Hz. The average velocity for section QP is 25 cm s^{-1}.

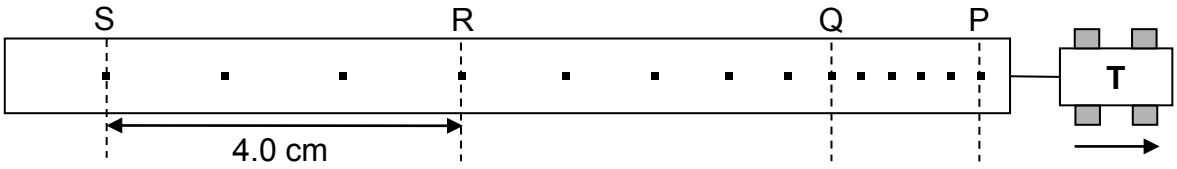


Fig. 24.1

(a) Calculate the average velocity of the trolley for section SR.

average velocity for section SR = ……..[1]

(b) Calculate the average acceleration of the trolley for section QR.

average acceleration of the trolley for section QR = …… [2]

25 An astronaut has a mass of 75 kg.

(a) Calculate his weight on the Moon where the acceleration due to gravity is 1.6 m s^{-2}.

weight of astronaut on moon = …… [1]

(b) The maximum load the astronaut can lift on Earth is 100 N. State whether the astronaut is able to lift less, more or the same on the surface of the moon. Explain your answer. Ignore the effect of his space suit.

……

……

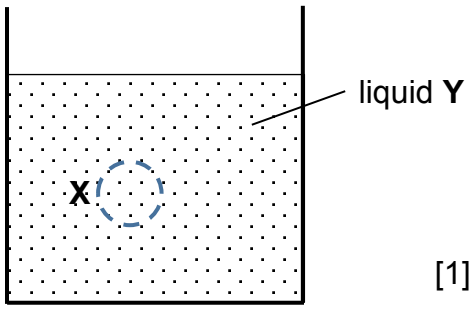
…… [2]

26 A sphere **X** of mass 9.0 g has a density of 0.45 g cm^{-3}

(a) Calculate the volume of sphere **X**.

volume of X = …… [1]

(b) Sphere **X** is released from rest in liquid **Y** at the position shown in the diagram. If liquid Y has a density of 0.90 g cm^{-3} draw the final position of sphere X on the diagram.



[1]

(c) State the net force acting on sphere X when it is at the final position.

net force = …… [1]

27 A horizontal force *F* pulls a cart towards the right. A pendulum bob of mass 0.60 kg is hanging from a retort stand on the cart. As the cart moves, the pendulum remains tilted at an angle of 20° to the vertical as shown in Fig. 27.1.

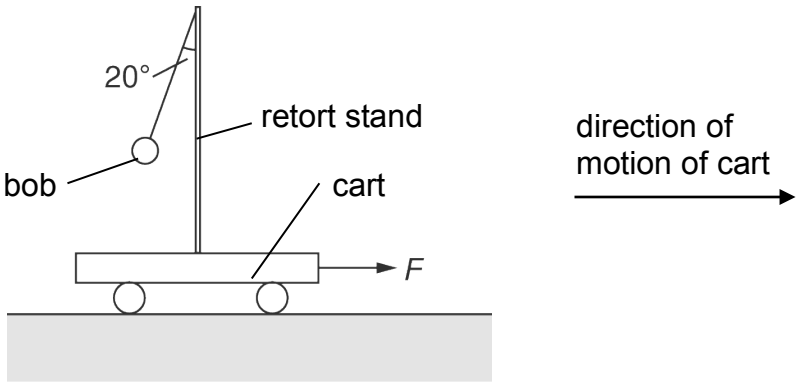


Fig. 27.1

(a) Draw a free body diagram and clearly label the forces acting on the pendulum bob when at the position shown in Fig. 27.1. [2]

bob ○

(b) By drawing a scaled diagram or otherwise, determine the net force on the pendulum bob when it is moving horizontally towards the right.

net force = …….. [2]

(c) Hence, calculate the acceleration of the pendulum bob.

acceleration = …….. [2]

Section C (10 marks)

Write your answers in the spaces provided.

Given formulae:	$v = r\omega$;	$a = \frac{v^2}{r}$;	$F = \frac{Gm_1m_2}{r^2}$

28 **(a)** Mass of Earth = 6.0×10^{24} kg
Radius of Earth = 6.4×10^{6} m
Universal gravitational constant, G = 6.7×10^{-11} N m^2 kg^{-2}

The Hubble space telescope is in orbit about Earth at a height of 600 km above Earth's surface.

(i) Calculate the gravitational acceleration at that height.

gravitational acceleration = …….. [3]

(ii) Calculate the linear speed of this telescope.

linear speed = …….. [2]

(iii) The mass of the telescope is 11 000 kg.
Determine the gravitational pull exerted on the telescope by Earth.

gravitational pull = …….. [1]

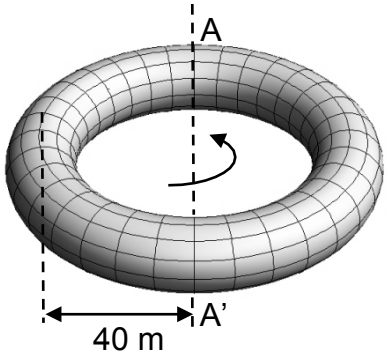
(iv) Suggest a reason why the telescope is placed at this orbit about Earth instead of locating it on Earth's surface.

……..

……..

……[1]

(b) A space station is made roughly in the shape of a doughnut and rotates about an axis AA' as shown in Fig. 28.1.



Adapted from http://www.happehtheory.com/wp-content/uploads/2011/10/TorusView-Base.jpg

Fig. 28.1

Fig. 28.2 shows the cross-sectional view across a diameter of this space station which has a radius of 40 m.

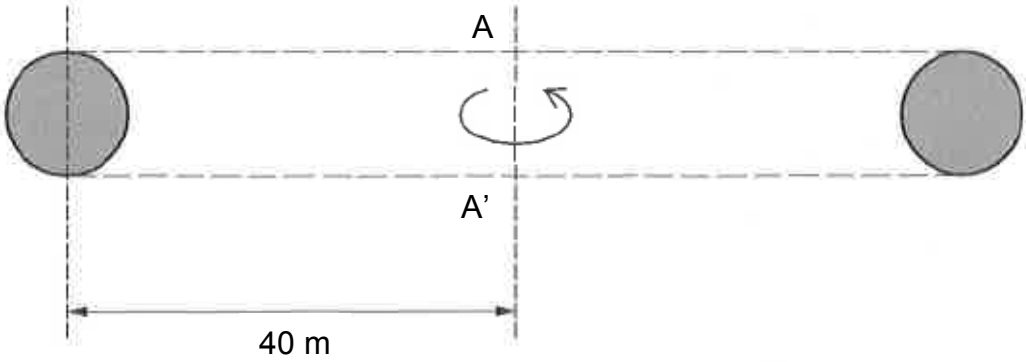


Fig. 28.2

(i) Determine the period of rotation of the space station about the axis AA' in order that someone living inside it may experience a centripetal acceleration of g = 10 m s^{-2}.

period of rotation = …….. [2]

(ii) Suggest one problem likely to be experienced by an astronaut living and working in such a rotating space station.

……..

……..

……[1]

End of paper

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