Class	Register Number	Name

南洋女子中学校

NANYANG GIRLS' HIGH SCHOOL
End-of-Year Examination 2018
Secondary Three

PHYSICS — **1 hour 45 minutes**

Paper 2 Theory Paper — **10:00 – 11:45**

Tuesday **9 October 2018**

No additional materials are required.

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.

Write in dark blue or black ink. You may use a pencil for any diagrams or graphs.
Do not use correction fluid or tape.

Section A (40 marks)
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B (30 marks)
Answer **all** questions.
Question **9** has a choice of parts to answer: **9** ***Either*** or **9** ***Or***.
Write your answers in the spaces provided on the question paper.

Circle 9 Either or **9 Or** in the grid on the right to indicate which question you have answered.

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 one hour on Section A and no longer than 45 minutes on Section B.

Candidates are reminded that **all** quantitative answers should include appropriate units. 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.
The use of an approved scientific calculator is expected, where appropriate.

The acceleration due to gravity (or gravitational field strength) g is taken to be 10 m s^{-2} (or 10 N kg^{-1}) near the Earth's surface.

Examiner's Use	
Section A (40 marks)	
1	
2	
3	
4	
5	
6	
Section B (30 marks)	
7	
8	
9 Either	
9 Or	
Paper 2 (70 marks)	

Paper 1 (30 marks)	

Overall
%

This document consists of **17** printed pages and **1** blank page.

Section A (40 marks)
Answer **all** questions.

1 A company buys corrugated cardboard to make boxes. The cardboards are bundled up as shown in Fig. 1.1.

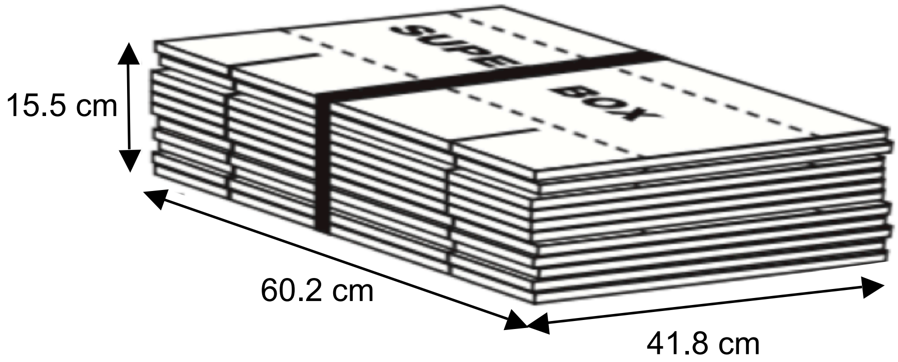

Fig. 1.1

(a) Each bundle of cardboards has a mass of 8.4 kg and dimensions 15.5 cm by 60.2 cm by 41.8 cm.

(i) Name the instrument used to measure the dimensions of the cardboard and state its precision.

instrument = ……………………………. precision = ……………………..[2]

(ii) Calculate the volume of the bundle of cardboards.

volume = ……………………..[1]

(iii) Calculate the density of the corrugated cardboard in S.I. units.

density = …………………………..[2]

(b) Corrugated cardboard is made up of three sheets of thick paper stuck together. Fig. 1.2 shows an enlarged view of the edge of a sheet of corrugated cardboard.

Fig. 1.2

State and explain whether the density of the paper is *greater*, the *same* or *lower* than the average density of the corrugated cardboard.

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………[2]

2 Fig. 2.1 shows a "tower drop" theme park ride. The passengers on the gondola are lifted to a height and then dropped.

gondola

Source:
https://www.tripadvisor.co.uk/LocationPhotoDirectLink-g551774-d673946-i106562587-M_D_s_Scotlands_Theme_Park-Motherwell_North_Lanarkshire_Scotland.html

Fig. 2.1

The graph in Fig. 2.2 shows how the velocity of the gondola changes with time during the ride.

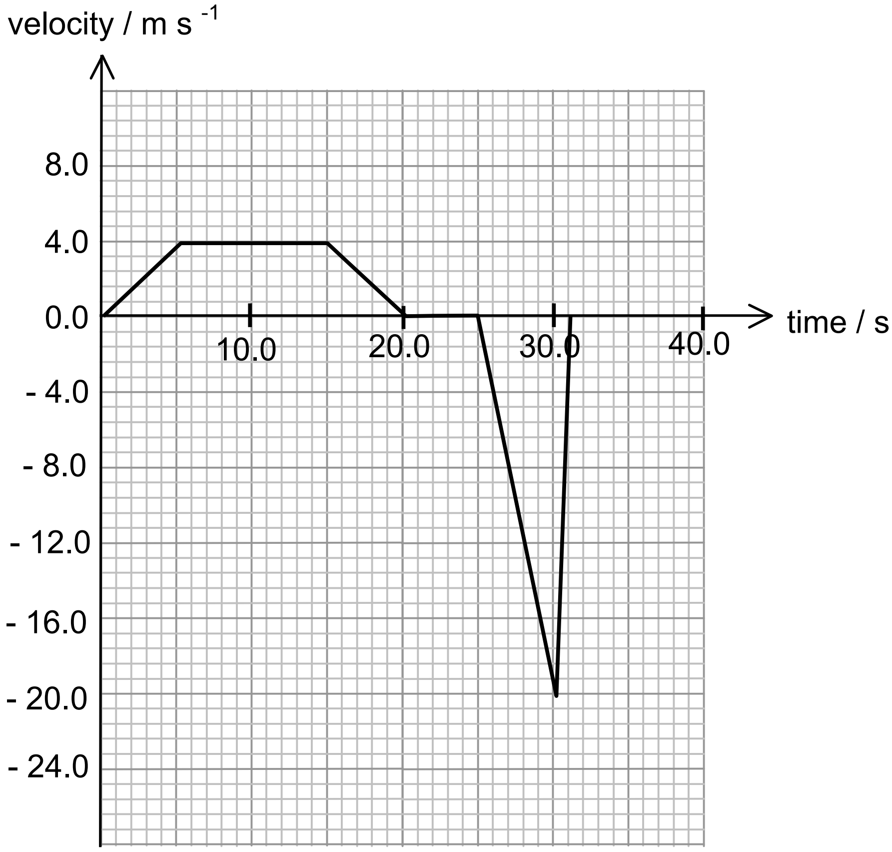

Fig. 2.2

(a) Define the term *velocity*.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

………………………………………………………………………………………………...[1]

(b) State and justify whether the passengers on the gondola experience free-fall during the drop.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

………………………………………………………………………………………………...[2]

(c) At 4.0 s, a passenger on the gondola dropped a key.

(i) State the initial velocity of the key.

velocity = ……………………………. [1]

(ii) Determine the time it takes for the key to fall to the ground.

time = ……………………………. [3]

(iii) Sketch on Fig. 2.2, the velocity-time graph of the key from 4.0 s until it hits the ground. [2]

3 **(a)** State the difference between a scalar and a vector quantity.

……………………………………………………………………………………………..

……………………………………………………………………………………………..

……………………………………………………………………………………………[1]

(b) Force is a vector quantity. State one other example of a vector quantity.

……………………………………………………………………………………………[1]

(c) Fig. 3.1 shows the top of a flagpole. The flagpole is held vertical by two ropes X and Y.

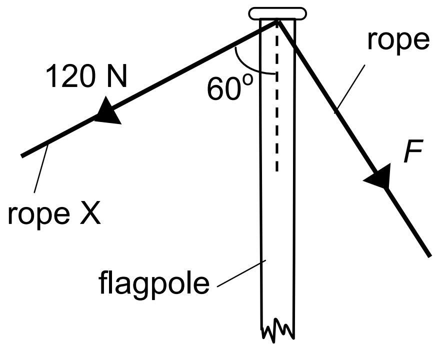

Fig. 3.1

A force of 120 N acts on rope X at an angle of 60° to the flagpole. The resultant force of magnitude 350 N acts vertically downward on the pole.
In the space below, draw a scaled diagram to find the magnitude of the force *F* on the rope Y and the angle that rope Y makes with the vertical. State the scale used.

scale used = …………………………….[1]

F = ………..…..……… [2]

angle = ………………..[1]

(d) State **two** changes that can be made to rope X to increase the force *F* in rope Y, without changing the magnitude and direction of the resultant force.

(i) ……………………………………………………………………………………

(ii)……………………………………………………………………………………[2]

4 Fig. 4.1 shows a balancing toy bird. The bird is made of wood and it has a metal piece stuck to its tail. When placed on a rod, the toy balances in equilibrium at the position shown in Fig. 4.1.

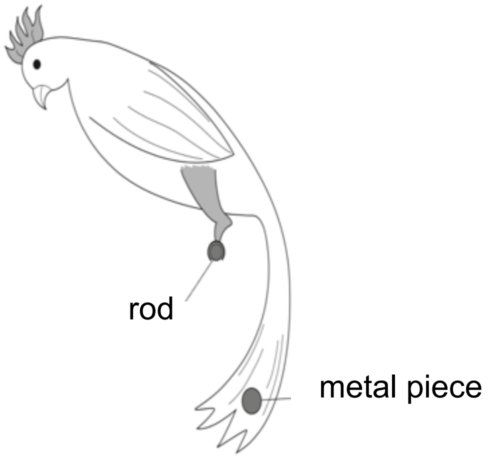

Fig. 4.1

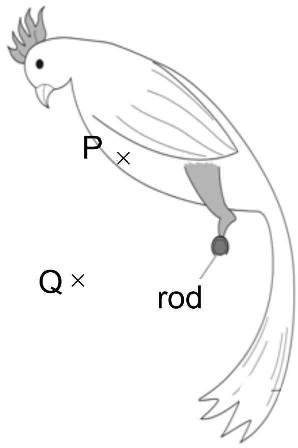

Fig. 4.2

(a) On Fig. 4.1, mark with a cross and label with the letter G, a possible position for the centre of gravity of the toy. [1]

(b) The metal piece falls off the tail as shown in Fig. 4.2.

(i) Two points (P and Q) are marked with crosses on Fig. 4.2.
State and explain which point (P or Q) is likely to be the centre of gravity of the toy without the metal piece.

……………………………………………………………………………………

……………………………………………………………………………………[1]

(ii) State and explain what happens to the toy immediately after the metal piece falls off.

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………[2]

5 A manometer is filled with oil, water and mercury as shown in Fig. 5.1.

Atmospheric pressure = 1.00×10^5 Pa
Density of mercury = 1.36×10^4 kg m^{-3}
Density of water = 1.00×10^3 kg m^{-3}

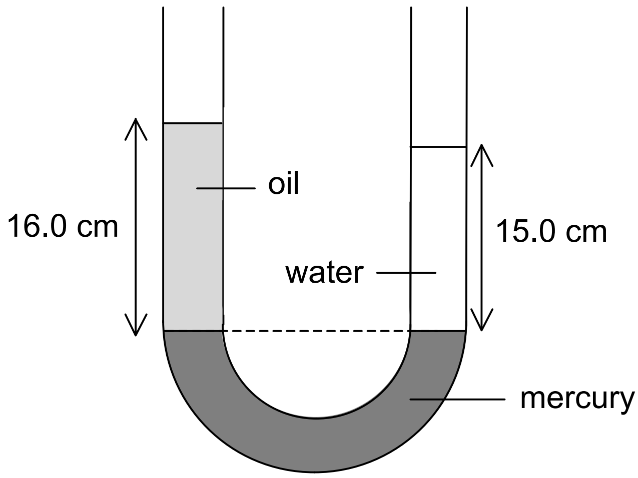

Fig. 5.1

(a) Determine the density of the oil.

density of oil = …………………………… [2]

(b) The oil in Fig. 5.1 is replaced with alcohol of the same volume, which is less dense than oil. State and explain any change in the mercury levels.

……………………………………………………………………………………

……………………………………………………………………………………[2]

6 Fig. 6.1 shows the top down view of an arrangement where a plane mirror is used in a shop to observe a display AB.

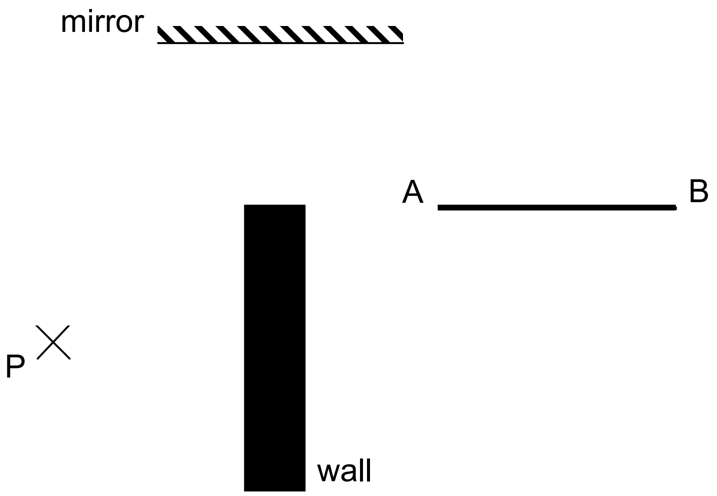

Fig. 6.1

(a) Locate the position of the image of the display and label it as A'B'. [1]

(b) Draw a light ray from A to show how a customer at P is able to see end A of the display. [2]

(c) Mark the angle of incidence for the ray drawn in **(b)** and label it *i*. [1]

(d) The customer observed that the display cannot be fully seen from P.

(i) Determine the furthest point on the display which he can see from P and label it as C. Show clearly how you arrive at your answer. [2]

(ii) State two changes that can be made to the mirror in order for the whole display to be seen from P.

Change 1: ....

Change 2: ....[2]

Section B (30 marks)

Answer all the questions in this section.
Answer only one of the two alternative questions in Question **9**.

7 **(a)** State the *principle of moments*.

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

…………………………………………………………………………………………… [2]

(b) Fig. 7.1 shows a 6.0 m long barrier pivoted as shown. The barrier is raised to allow cars to pass.
The barrier has a weight of 450 N that acts at a distance of 2.0 m from the pivot as shown in Fig. 7.1.

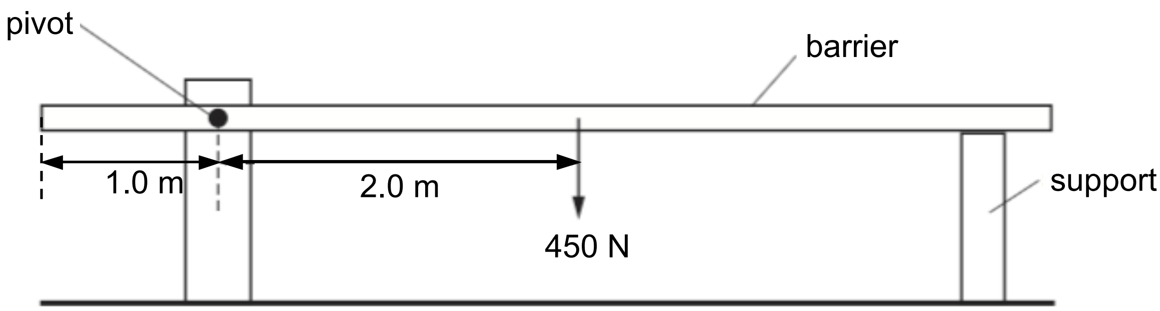

Fig. 7.1

(i) Determine the moment of the weight of the barrier about the pivot.

moment = …………………………………… [2]

(ii) Explain how the moment of the weight of the barrier about the pivot changes as the barrier is raised.

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………[1]

(c) A force is used to raise the barrier off the support.

On Fig. 7.1, draw an arrow and label it *F* to show the position and direction of the smallest force on the barrier that can used to raise the barrier. [1]

(d) To reduce the force marked in **(c)**, a 200 N load is added as shown in Fig. 7.2. The load acts 0.40 m from the pivot.

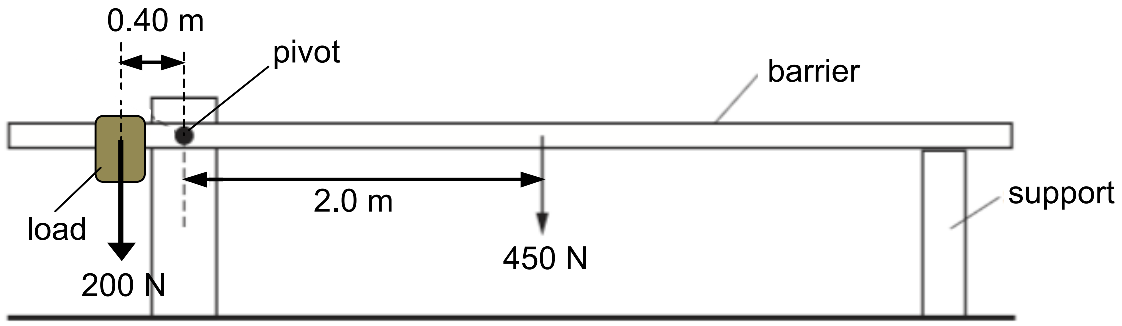

Fig. 7.2

(i) State the magnitude of the normal contact force that acts on the barrier by the support when the barrier is just lifted off the support.

normal contact force = …………………[1]

(ii) Determine the minimum force *F* marked in **(c)** that will just lift the barrier off the support.

minimum force = ……………………………. [3]

8 **(a)** A ball of mass 200 g is thrown vertically upwards with a speed of 6.0 m s^{-1}. Assume air resistance is negligible.

(i) State the *principle of conservation of energy*.

……………………………………………………………………………………

……………………………………………………………………………………[1]

(ii) Describe the energy changes as the ball travels to its maximum height.

……………………………………………………………………………………

……………………………………………………………………………………[1]

(iii) Calculate the maximum height reached by the ball.

maximum height = ……………………………. [2]

(iv) The ball is now thrown upwards with twice the speed. Without any calculations, state and explain the new maximum height reached by the ball.

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………[2]

(b) In reality, it is observed that when the ball is thrown vertically upwards with a speed of 6.0 m s^{-1}, it does not reach the maximum height calculated in **(a)(iii)** due to the presence of air resistance.

(i) Given that the maximum height reached is 1.5 m, calculate the work done against air resistance.

work done = ……………………………. [2]

(ii) Hence, or otherwise, calculate the average magnitude of air resistance experienced by the ball as it travels to its maximum height.

average air resistance = ……………………………. [2]

9 EITHER

In Fig. 9.1, a 4.0 kg block Q moves up a rough slope at a constant speed of 0.50 m s^{-1}. It is attached to a 4.5 kg block P by a light inextensible string that passes over a smooth pulley. The slope is inclined at an angle of 40^o to the horizontal.

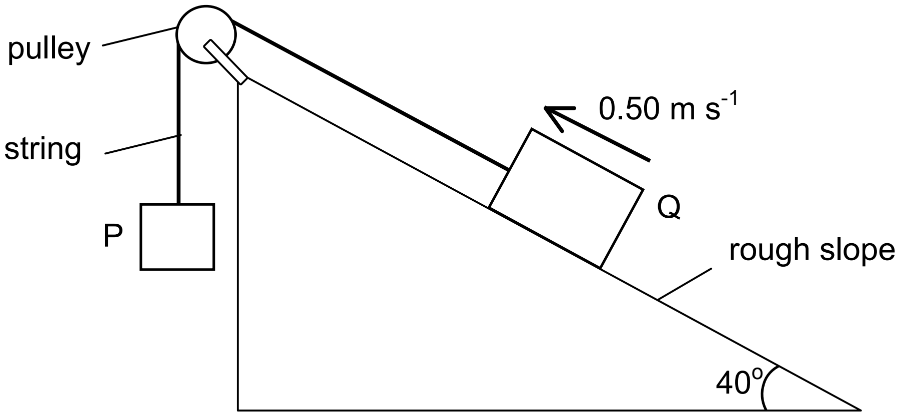

Fig. 9.1

(a) Explain what is meant by a *light inextensible* string.

…………………………………………………………………………………………………..

…………………………………………………………………………………………………..

…………………………………………………………………………………………………[1]

(b) In Fig. 9.2, draw and clearly label all the forces acting on each block. [3]

Fig. 9.2

(c) (i) State the magnitude of the tension in the string.

tension = ………………. [1]

(ii) Calculate the magnitude of the frictional force acting on block Q.

frictional force = ………….………. [3]

(iii) As block Q moves up the slope at the constant speed of 0.50 m s^{-1}**,** the string suddenly breaks. Describe and explain the subsequent motion of block Q.

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………[2]

9 OR

Fig. 9.3 below shows a J-shaped tube containing 25.0 cm^3 of an unknown gas trapped by mercury. The mercury levels are the same on both sides of the tube. Subsequently, more mercury is poured into the open tube until the levels differ by 9.0 cm as shown in Fig. 9.4. The atmospheric pressure is 1.0×10^5 Pa and the density of mercury is 1.36×10^4 kg m^{-3}.

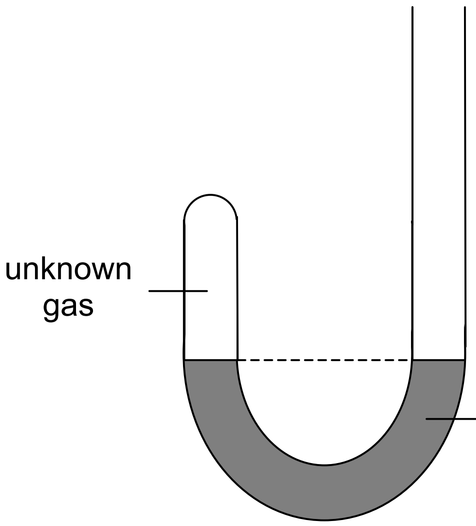

Fig. 9.3

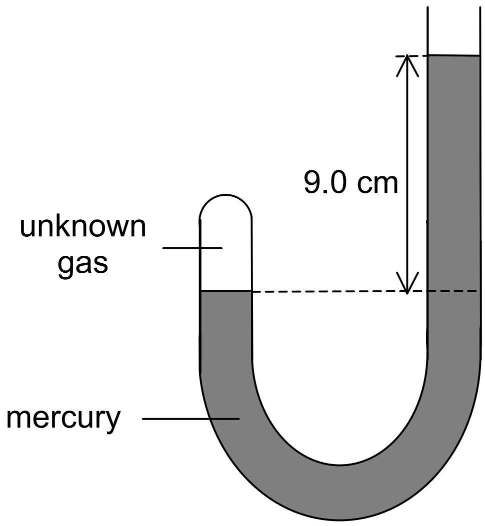

Fig. 9.4

(a) State the pressure of the unknown gas in Fig. 9.3.

pressure of unknown gas = ……………………………. [1]

(b) On Fig. 9.4, identify two points within the mercury fluid where pressure is the same. Label them M and M'. [1]

(c) Hence, or otherwise, determine the pressure of the unknown gas in Fig. 9.4.

pressure of unknown gas = ……………………………. [2]

(d) State the two conditions necessary for Boyle's Law to be applied.

……………………………………………………………………………………………..

……………………………………………………………………………………………..

……………………………………………………………………………………………[2]

(e) Determine the new volume of the unknown gas in Fig. 9.4.

volume of unknown gas = ……………………………. [2]

(f) A small amount of mercury is removed from the J-shaped tube in Fig. 9.4.

State and explain the change in the height difference between the mercury levels, if any.

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……………………………………………………………………………………………..

……………………………………………………………………………………………..

……………………………………………………………………………………………[2]

End of Paper

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