Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4503/01

S15-4503-01

PHYSICS

PHYSICS 3
FOUNDATION TIER

P.M. WEDNESDAY, 20 May 2015

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**6**	
2.	**10**	
3.	**11**	
4.	**9**	
5.	**11**	
6.	**7**	
7.	**6**	
Total	**60**	

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ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.
Write your name, centre number and candidate number in the spaces at the top of this page.
Answer **all** questions.
Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.
You are reminded of the necessity for good English and orderly presentation in your answers.
A list of equations is printed on page 2. In calculations you should show all your working.
You are reminded that assessment will take into account the quality of written communication (QWC) used in your answer to question **7**.

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Equations

speed = $\frac{\text{distance}}{\text{time}}$	
u = initial velocity v = final velocity t = time a = acceleration x = displacement	$v = u + at$ $x = \frac{1}{2}(u + v)t$
momentum = mass × velocity	$p = mv$
pressure = $\frac{\text{force}}{\text{area}}$	$p = \frac{F}{A}$
	T / K = θ / °C + 273
density = $\frac{\text{mass}}{\text{volume}}$	$\rho = \frac{m}{V}$

SI multipliers

Prefix	Multiplier	
m	10^{-3}	$\frac{1}{1\,000}$
k	10^{3}	1 000
M	10^{6}	1 000 000

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Answer **all** *questions.*

1. *(a)* Name the **two** main gases that were present after the Big Bang. All stars are made from these gases. [2]

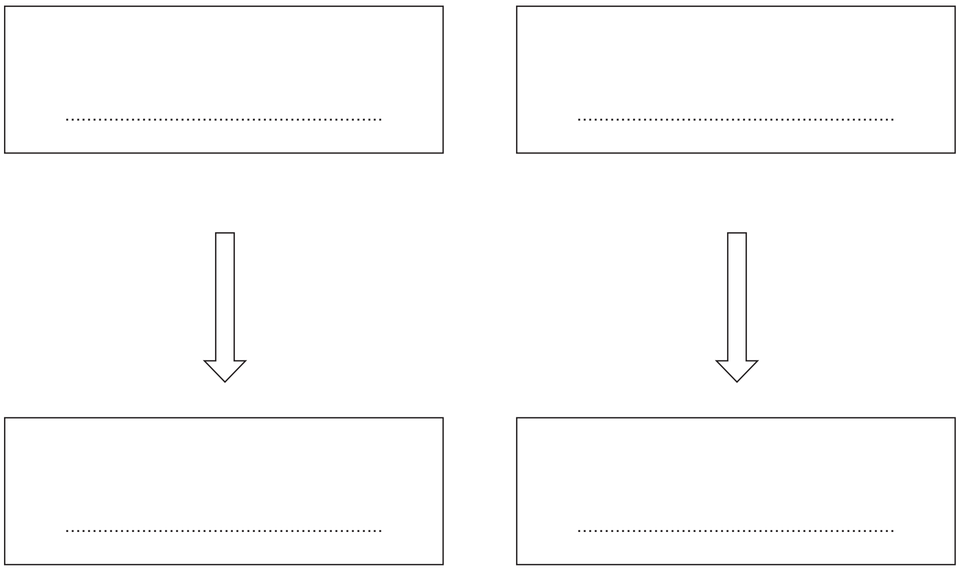
.... and ....

(b) When main sequence stars reach the end of their "lives", the stages that they go through depend on their mass.
Choose words or phrases from the box to complete the diagram below. [4]

supernova	white dwarf	black hole	red giant	brown dwarf

Our Sun

Stars more massive than our Sun



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6

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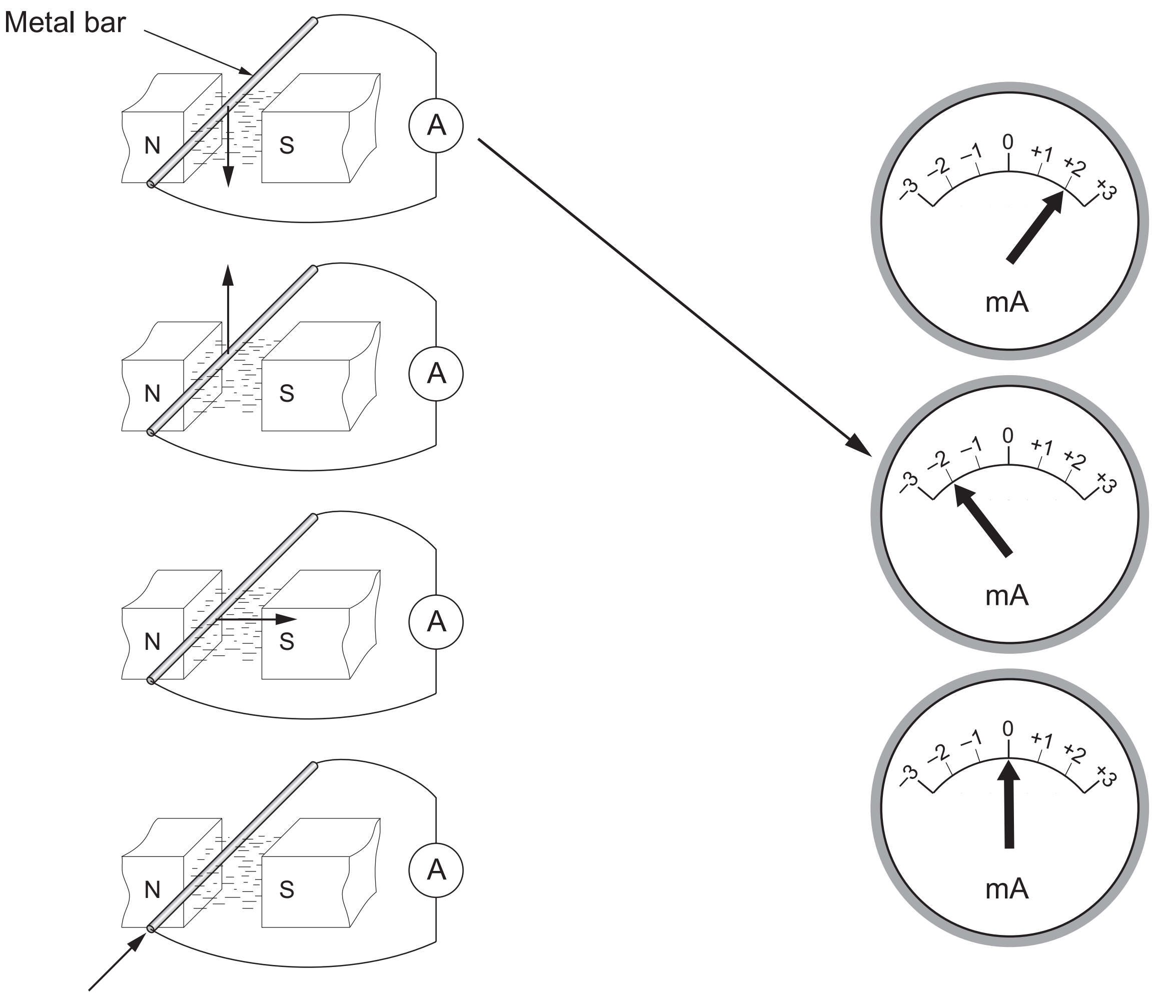
2. *(a)* The diagram below shows a bar magnet with the poles labelled. Draw the magnetic field around the magnet. [2]

(b) A student sets up the apparatus as shown in the diagrams on the left below. The student moves the metal bar in the direction shown by the arrow in each case.

(i) Join with a line, the diagrams of the apparatus to the ammeter diagrams you would expect on the right. The first one is done for you. **Each ammeter diagram may be used once, more than once, or not at all.** [3]



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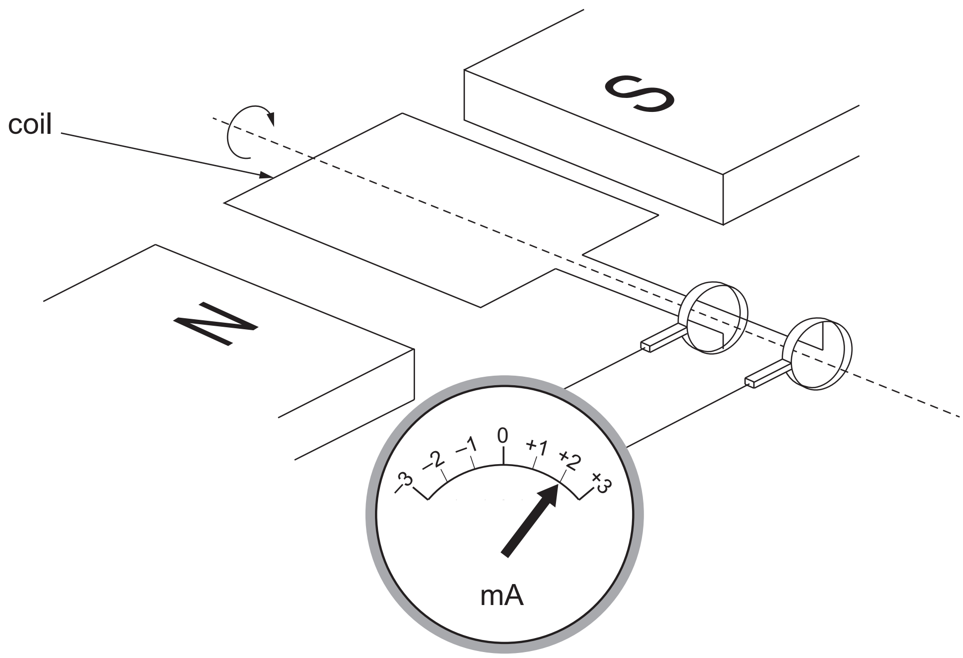
(ii) State **two** changes the student could make to get an ammeter reading bigger than 2 mA. [2]

1. ....

2. ....

(c) The student now carries out a new experiment with the metal bar changed to a coil as shown below.



(i) Describe how the ammeter needle moves as the coil spins. [1]

....

....

(ii) Explain your answer. [2]

....

....

....

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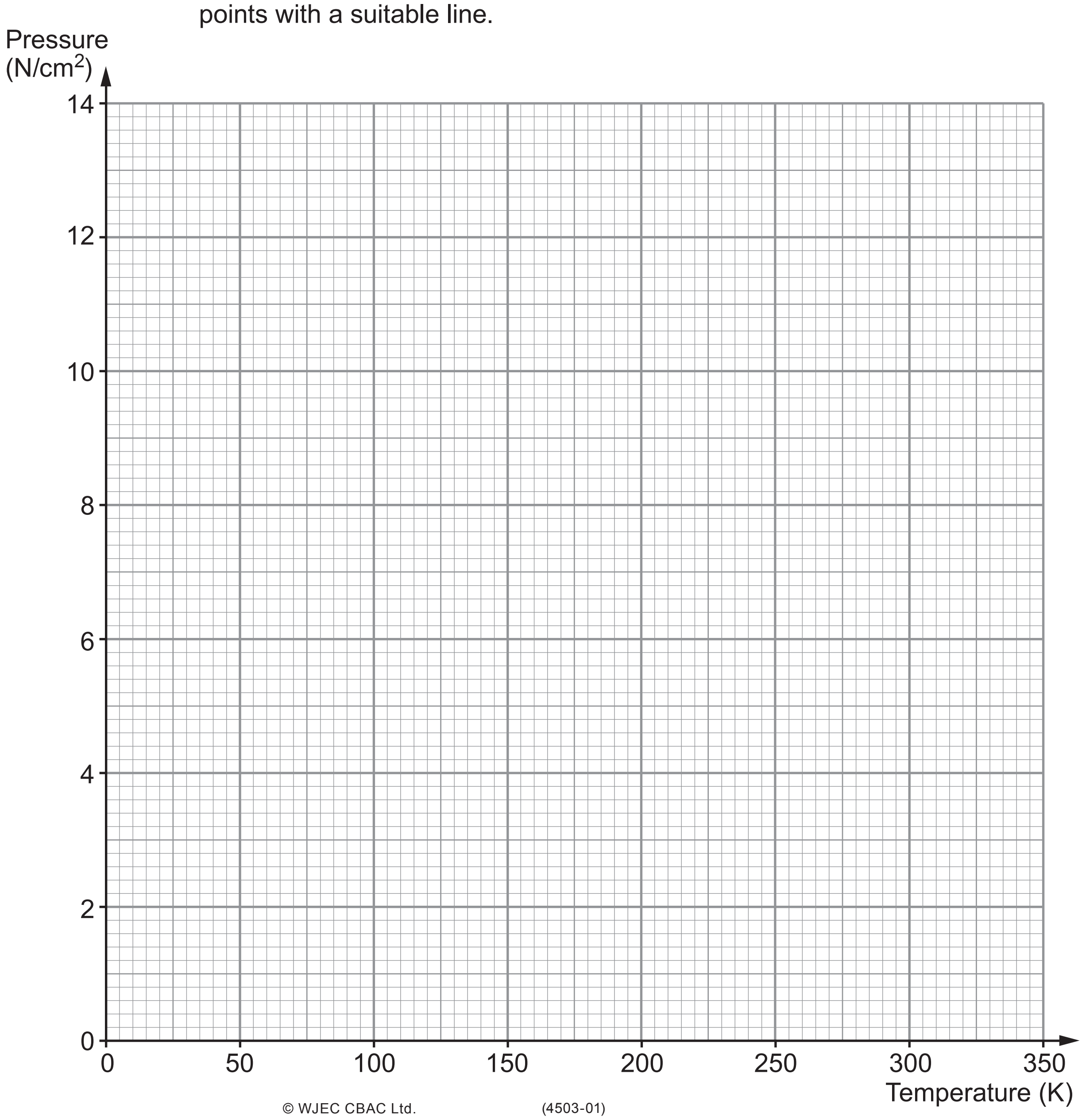
3. A fixed mass of gas is kept at a constant volume in a sealed container. The container is heated and the pressure at different temperatures is recorded in the table below.

Temperature (°C)	Temperature (K)	Pressure (N/cm^2)
−73	200	8
−23	250	10
2	275	11
....	300	12
77	....	14

(a) (i) **Complete** the table. [2]

(ii) Plot the pressure of the gas against its temperature on the grid below and join the points with a suitable line. [3]



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(iii) Use your graph to find the pressure of the gas at 0 K. [2]

pressure = ... N/cm^2

(iv) Describe the relationship between the pressure of the gas and its temperature as shown by the graph. [2]

....

....

(b) The area of the top of the container is $80\,cm^2$. Calculate the force exerted by the gas on the top at a temperature of 300 K using the equation: [2]

force = pressure × area

force = ... N

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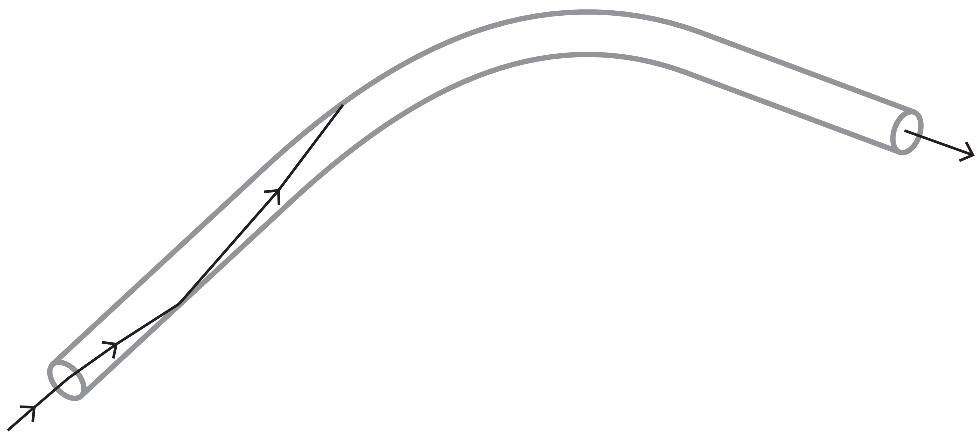
4. *(a)* Tick (✓) the boxes next to the **two** correct statements below that are required for total internal reflection to take place. [2]

Light must be directed to a more dense material	☐
The angle of incidence must be less than the critical angle	☐
The angle of incidence must be equal to the critical angle	☐
Light must be directed towards a less dense material	☐
The angle of incidence must be greater than the critical angle	☐

(b) The diagram below shows part of the path of light through an optical fibre. **Complete** the diagram to show the rest of the path taken by the light. [3]



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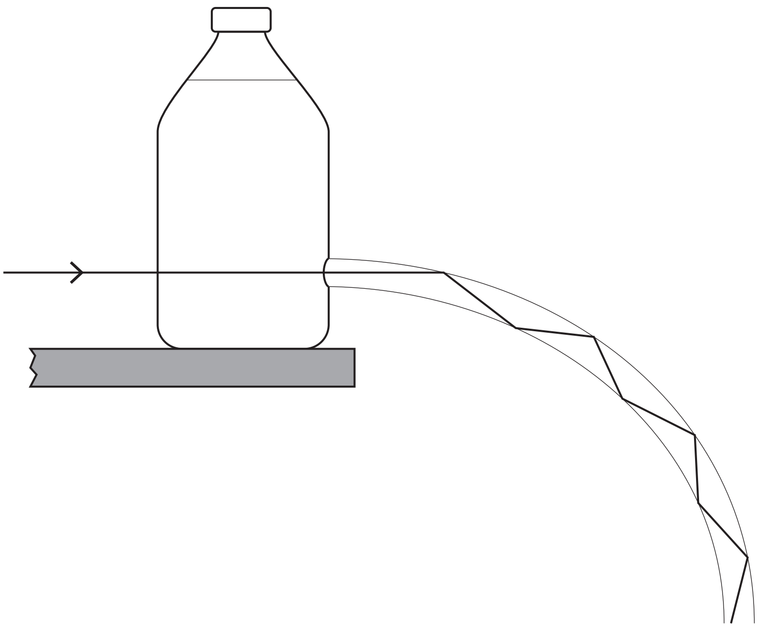
(c) The diagram below shows laser light travelling along a stream of water. The critical angle for water is 48°.



Complete the table below by using the statements in the column heading to identify what happens to the ray of light in **each** case. [4]

Light travelling from	Light travelling to	Angle of incidence	At the boundary, does the ray of light: • refract; • totally internally reflect; • travel along the boundary?
water	air	35°	....
water	air	48°	....
water	air	52°	....
water	air	60°	....

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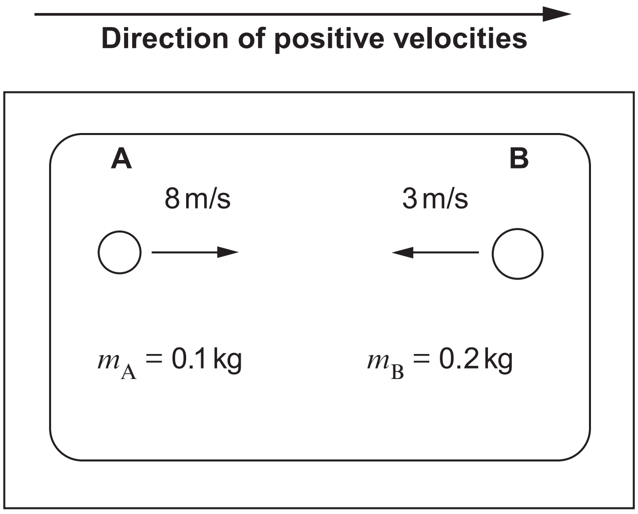
5. *(a)* A sliding disc **A** of mass (m_A) 0.1 kg travelling with a velocity of +8 m/s on a frictionless table hits another disc **B** of mass (m_B) 0.2 kg travelling with a velocity of –3 m/s.



(i) Use an equation from page 2 to calculate the initial momentum of disc **A**. [2]

momentum = ... kg m/s

(ii) Calculate the initial momentum of disc **B**. [1]

momentum = ... kg m/s

(iii) Calculate the **total** momentum before the collision. [1]

total momentum = ... kg m/s

(iv) Write down the **total** momentum after the collision. [1]

total momentum = ... kg m/s

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(v) After the collision, disc **A** stops moving.

Use the equation:

$$\text{velocity} = \frac{\text{total momentum}}{\text{mass}}$$

to calculate the velocity of disc **B** after the collision. [2]

velocity of disc **B** = ... m/s

(b) Disc **A** decelerates at 160 m/s^2 during the collision.

(i) Use the equation:

$$t = \frac{(v - u)}{a}$$

to calculate how long the collision takes. [2]

time = ... s

(ii) Disc **A** applies a mean force of 1.6 N to disc **B** during the impact. Write down the **size** and **direction** of the mean force applied to disc **A** by disc **B** in the collision. [2]

....

....

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6. The Sun is in a stable state in the main sequence stage of its "life".

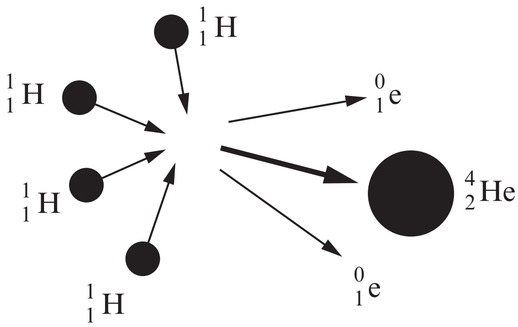
(a) (i) Name the forces acting on the Sun. [1]

....

(ii) State why the Sun is in a stable state at present. [1]

....

(b) The Sun generates most of its energy by the nuclear reaction shown in the diagram.



(i) Write the nuclear equation for this reaction. [1]

$$\longrightarrow$$

(ii) Describe this reaction, naming the particles involved. [3]

....

....

....

....

(c) State what happens when a particle $^{0}_{1}$e collides with a particle $^{0}_{-1}$e. [1]

....

7

Examiner only

7. Use your knowledge of the kinetic theory of matter to explain how heat energy is transferred by conduction in **metals** and by convection in **gases**. [6 QWC]

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6

END OF PAPER

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