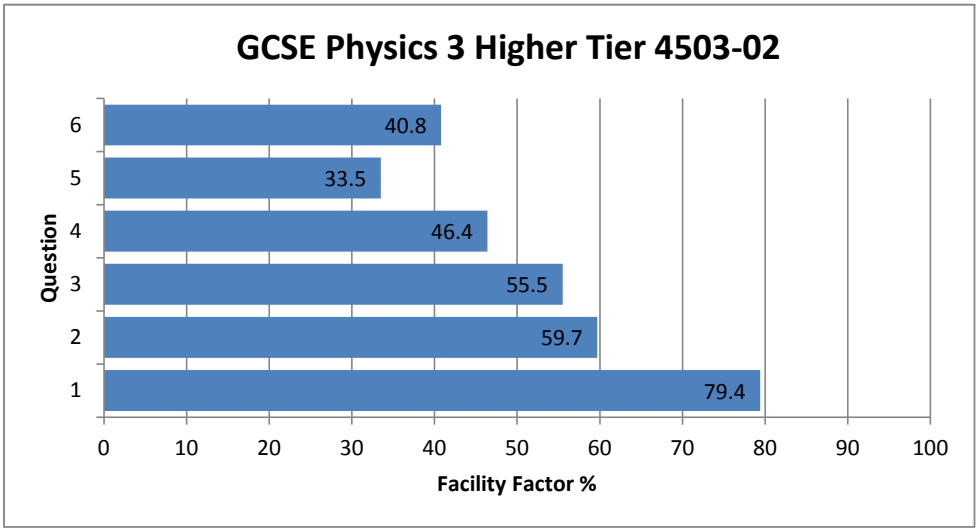
WJEC 2014 Online Exam Review

GCSE Physics 3 Higher Tier 4503-02

All Candidates' performance across questions

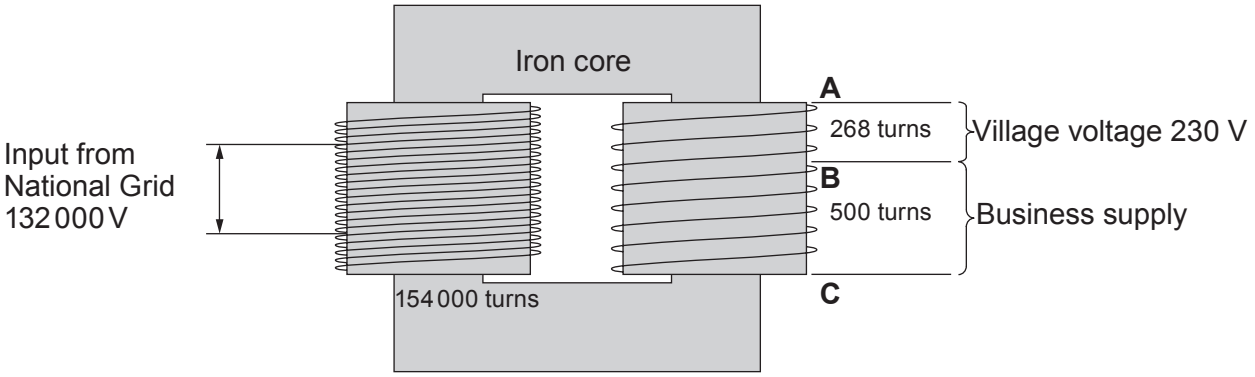
Question Title	N	Mean	S D	Max Mark	F F	Attempt %
1	3522	9.5	1.5	12	79.4	100
2	3519	3.6	1.5	6	59.7	99.9
3	3517	6.1	2.4	11	55.5	99.9
4	3517	5.1	2.6	11	46.4	99.9
5	3486	2.7	2.5	8	33.5	99
6	3502	4.9	2.4	12	40.8	99.4

4
5
6c



Examiner only

4. A transformer supplies both a village and a business with electricity from the National Grid. The business and the village need electricity at different voltages so they are connected to different numbers of secondary turns on the iron core of the transformer.



(a) Using an equation from page 2 and information from the diagram calculate the voltage supplied to the business. [3]

business supply voltage = ... V

(b) During a severe storm the connections from the transformer are altered by a falling tree. The **village is now connected to A and C**.

(i) Explain what effect, if any, this would have on the voltage supplied to the village. [2]

.....

.....

.....

(ii) State the effect, if any, you would expect this to have on the village. [1]

.....

(iii) Explain what effect, if any, this would have on the business. [2]

.....

.....

.....

Examiner only

(c) Describe how a transformer works. [3]

.....

.....

.....

.....

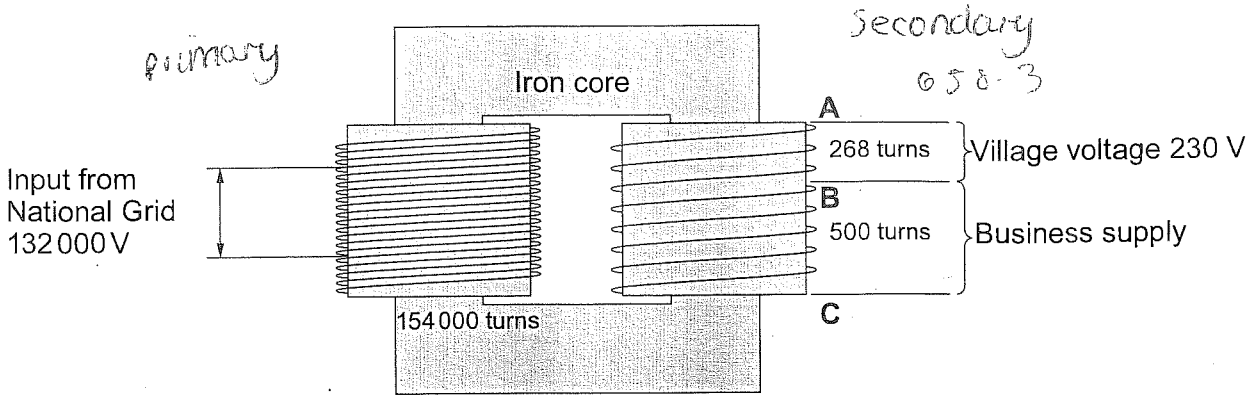
.....

11

Turn over.

Examiner only

4. A transformer supplies both a village and a business with electricity from the National Grid. The business and the village need electricity at different voltages so they are connected to different numbers of secondary turns on the iron core of the transformer.



(a) Using an equation from page 2 and information from the diagram calculate the voltage supplied to the business. [3]

$\frac{V_1}{V_2} = \frac{N_1}{N_2}$

$\frac{154000}{268}$ = 574.200...

$\frac{132,000}{574}$ = 658·285-230

428·3

$\frac{132,000}{x} = \frac{154000}{768}$

business supply voltage = 428·3 V

(b) During a severe storm the connections from the transformer are altered by a falling tree. The **village is now connected to A and C**.

(i) Explain what effect, if any, this would have on the voltage supplied to the village. [2]

They would have to share the voltage, it would mean no back up.

(ii) State the effect, if any, you would expect this to have on the village. [1]

The village would not be affected

(iii) Explain what effect, if any, this would have on the business. [2]

The business would have to share so if the village increases they're use then there is less for the business

Examiner only

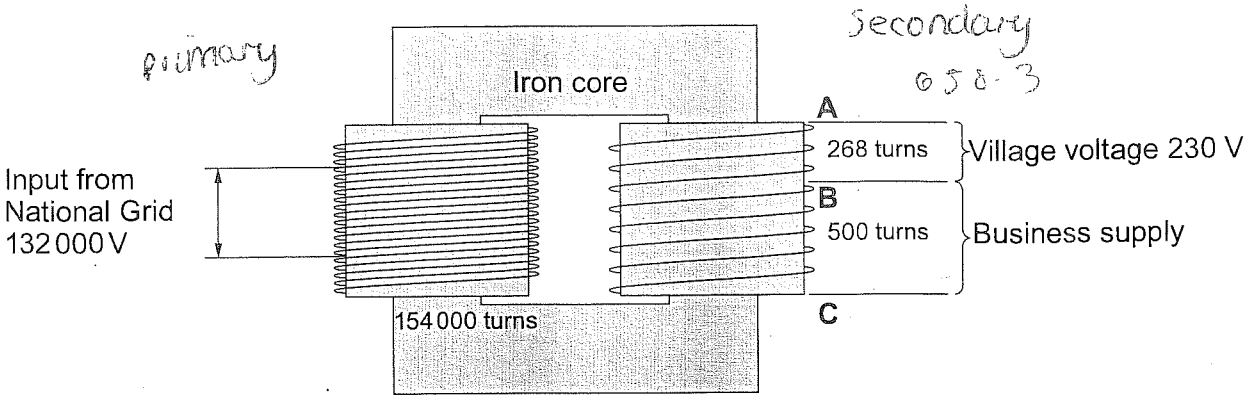
(c) Describe how a transformer works. [3]

An input voltage is inserted which creates an alternating current. This produces an alternating magnetic field at the iron core. The alternating magnetic field is then transferred to an alternating current on the secondary side. A step up transformer will increase the voltage and decrease the current. This transformer is a step down transformer so decrease the voltage and increases the current.

11

Examiner only

4. A transformer supplies both a village and a business with electricity from the National Grid. The business and the village need electricity at different voltages so they are connected to different numbers of secondary turns on the iron core of the transformer.



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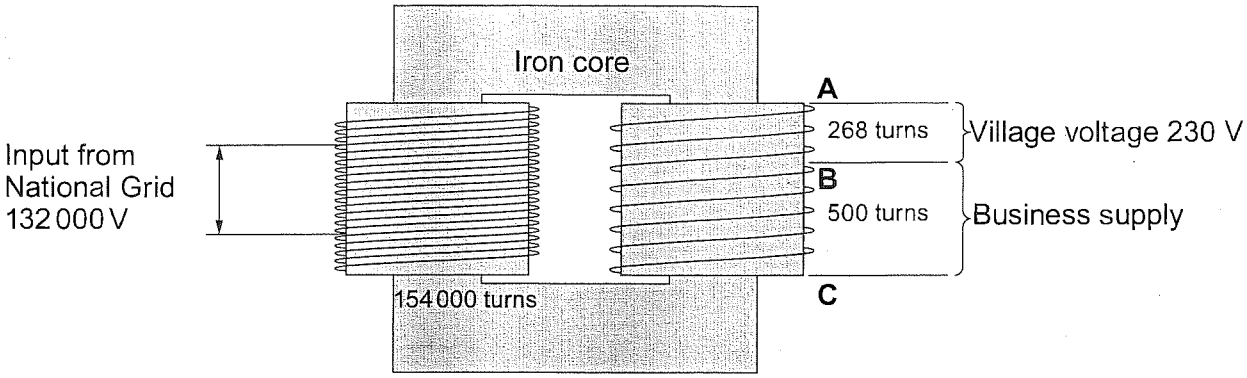


(a) Using an equation from page 2 and information from the diagram calculate the voltage supplied to the business. [3]

$\frac{V_1}{V_2} = \frac{N_1}{N_2}$ $\frac{132000}{154000} = 0.857142$

$500 \times 0.857142 = 428.6$

business supply voltage = 428.6 V

answer = 428.6 V

(b) During a severe storm the connections from the transformer are altered by a falling tree. The **village is now connected to A and C**.

(i) Explain what effect, if any, this would have on the voltage supplied to the village. [2]

the village would be recieving the total voltage of 658V

(ii) State the effect, if any, you would expect this to have on the village. [1]

this would mean that the village would recieve too much power and could be dangerous

(iii) Explain what effect, if any, this would have on the business. [2]

this would mean that the baiiness would not recieve any of the voltage meaning they would have no power supply

Examiner only

(c) Describe how a transformer works. [3]

In a transformer the voltage ~~current~~ in the primary coil creates a changing magnetic field which then creates a changing magnetic field in the iron core. The iron core strengthens the magnetic field and this links the magnetic field to the secondary coil and it induces a ~~current~~ voltage.

11

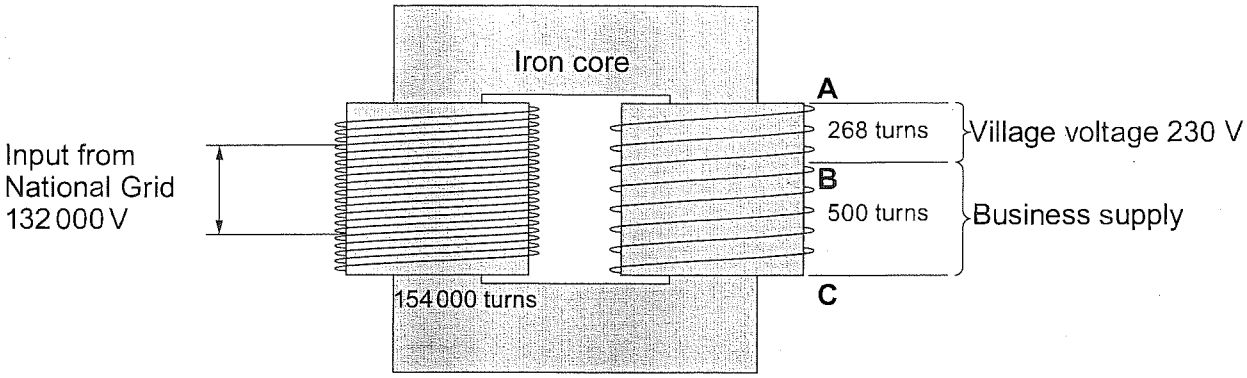
132000 | 154000 | 1.16

132000

1.16 × 50k = 58k

Examiner only

4. A transformer supplies both a village and a business with electricity from the National Grid. The business and the village need electricity at different voltages so they are connected to different numbers of secondary turns on the iron core of the transformer.



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business supply voltage = 428.6 V

answer = 428.6 V

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132000

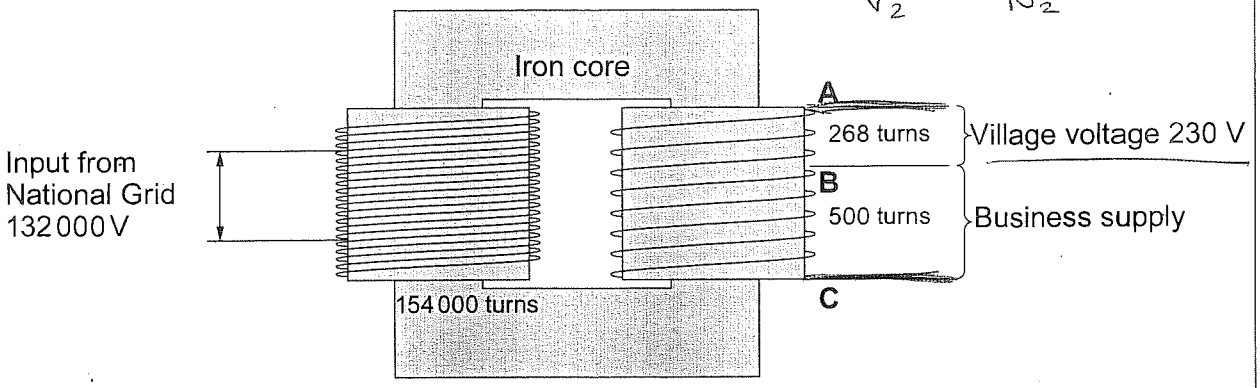
1.16 × 50 = 58

$\frac{V_1}{V_2} = \frac{N_1}{N_2}$ $\frac{132,000\ V}{?} = \frac{154,000}{268}$

Examiner only

4. A transformer supplies both a village and a business with electricity from the National Grid. The business and the village need electricity at different voltages so they are connected to different numbers of secondary turns on the iron core of the transformer.

$\frac{V_1}{V_2} = \frac{N_1}{N_2}$ 132,000



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$\frac{132,000}{V} = \frac{154,000}{500}$

business supply voltage = 635 V

(b) During a severe storm the connections from the transformer are altered by a falling tree. The **village is now connected to A and C**.

(i) Explain what effect, if any, this would have on the voltage supplied to the village. [2]

The village is now receiving the voltage for both the village and the business supply, therefore the voltage supplied to the village is greater

(ii) State the effect, if any, you would expect this to have on the village. [1]

There would be a greater efficency? or too much

(iii) Explain what effect, if any, this would have on the business. [2]

This would reduce the voltage supplied to the business therefore some appliances would not work as efficiently

Examiner only

(c) Describe how a transformer works. [3]

A transformer works by supplying an A.C (alternating current) The ~~primary coil~~ The current creates a magnetic field which then is able to travel around the magnetically permeable iron core. A current is induced at the secondary coil and a voltage is produced. More coils on primary, less on secondary, a step down transformer. There is less voltage, as product. (output)

11

meaning - primary coil
iron core
secondary coil.

$\frac{V_1}{V_2} = \frac{N_1}{N_2}$ $\frac{132,000}{?} = \frac{154,000}{268}$

Examiner only

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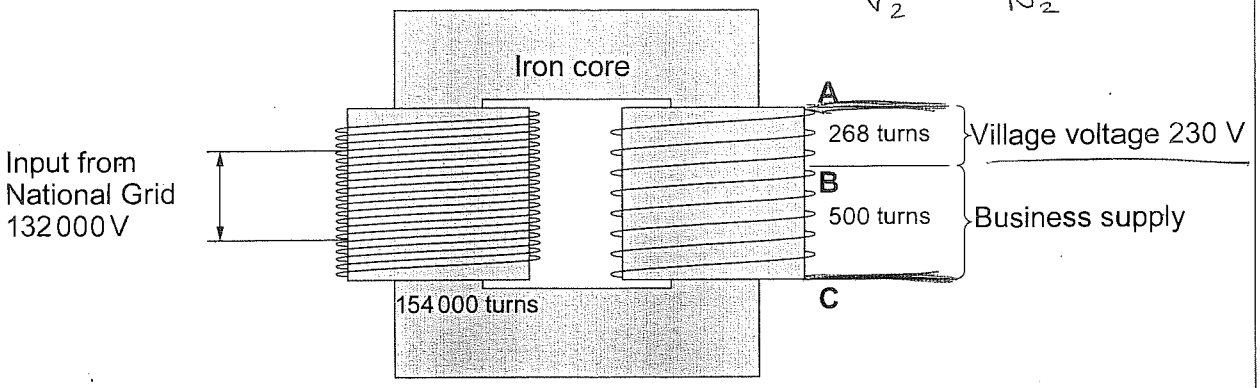

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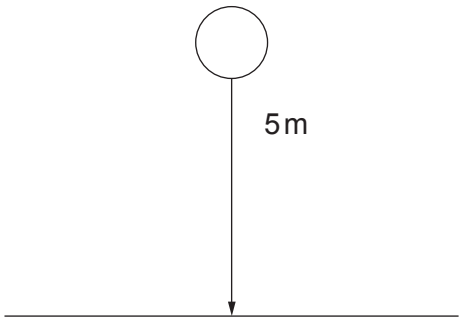
11

meron - primary coil
iron core
secondary coil.

Examiner only

5. A ball of mass 0.2 kg, initially at rest, is dropped from a height of 5 m.



Use equations from page 2 to answer the following questions.
Assume acceleration due to gravity = 10 m/s^2 and that air resistance is negligible.

(i) Calculate the speed with which the ball hits the ground. [3]

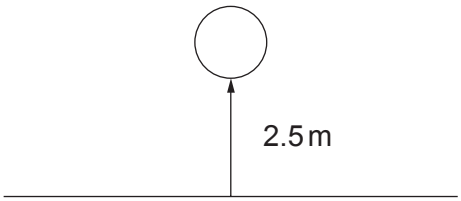
speed = ... m/s

(ii) As the ball rebounds it loses **half of its kinetic energy**. Calculate the rebound speed. [2]

speed = ... m/s

Examiner only

(iii) The ball rebounds to a maximum height of 2.5 m. Calculate how long it takes to reach this height after it rebounds. [3]



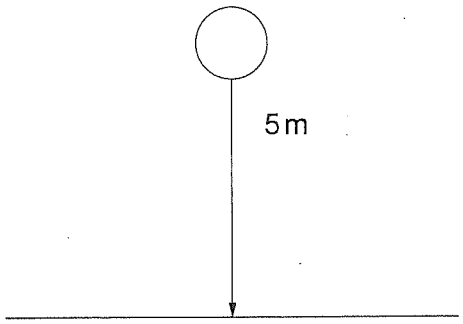
time = ... s

8

Turn over.

Examiner only

5. A ball of mass 0.2 kg, initially at rest, is dropped from a height of 5 m.



$u = 0$
$v = ?$
$t = ?$
$a = 10 m/s^2$
$x = 5$

Use equations from page 2 to answer the following questions.
Assume acceleration due to gravity = 10 m/s^2 and that air resistance is negligible.

(i) Calculate the speed with which the ball hits the ground. [3]

$v^2 = u^2 + 2ax$
$= 0^2 + 2 \times 10 \times 5$
$= 0^2 + 100$
$v^2 = 100$ $\quad v = 10$
$v = \sqrt{100}$

speed = 10 m/s

(ii) As the ball rebounds it loses **half of its kinetic energy**. Calculate the rebound speed. [2]

$KE = \frac{\text{mass} \times \text{speed}^2}{2}$
$= \frac{0.2 \times 10^2}{2}$
$= 10J$ Before

speed = 7.07 m/s

lost half

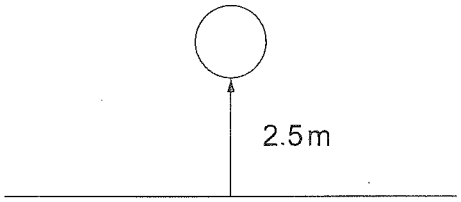
$5J = \frac{0.2 \times x^2}{2}$

$10J = 0.2 \times x^2$

$\sqrt{\frac{10J}{0.2}} = x^2$ $\quad = 7.07$

Examiner only

(iii) The ball rebounds to a maximum height of 2.5 m. Calculate how long it takes to reach this height after it rebounds. [3]



$u = 10$
$v = ?\ 0$
$t = ?$
$a = -10\,m/s^2$
$x = 2.5$

$$x = ut + \frac{1}{2}at^2$$

$$2.5 = 10 \times y + \frac{1}{2} \times -10 \times y^2$$

$$\frac{2.5}{10} = y + \frac{1}{2} \times -10 \times y^2$$

$0.25 =$

$$v^2 = u^2 + 2ax$$

$$v^2 = 10^2 + 2 \times -10 \times 2.5$$

$$v^2 = \sqrt{50}$$

$$v = 7.07$$

$$v = u + at$$

$$7.07 = 10 + -10 \times t$$

$$\frac{7.07}{10} = -10 \times t$$

0.07

$$v = u + at$$

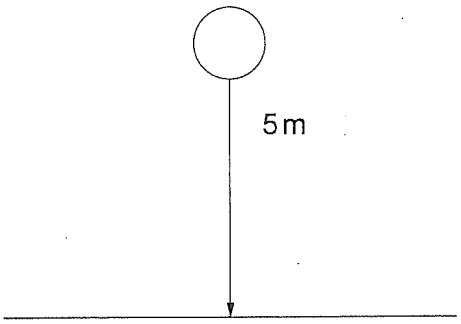
$$0 = 10 + -10 \times t$$

time = 7.07 s

8

Examiner only

5. A ball of mass 0.2 kg, initially at rest, is dropped from a height of 5 m.



$u = 0$
$v = ?$
$t = ?$
$a = 10 m/s^2$
$x = 5$

Use equations from page 2 to answer the following questions.
Assume acceleration due to gravity = 10 m/s^2 and that air resistance is negligible.

(i) Calculate the speed with which the ball hits the ground. [3]

$v^2 = u^2 + 2ax$
$= 0^2 + 2 \times 10 \times 5$
$= 0^2 + 100$
$v^2 = 100$ $\quad v = 10$
$v = \sqrt{100}$

speed = 10 m/s

(ii) As the ball rebounds it loses **half of its kinetic energy**. Calculate the rebound speed. [2]

$KE = \frac{\text{mass} \times \text{speed}^2}{2}$
$= \frac{0.2 \times 10^2}{2}$
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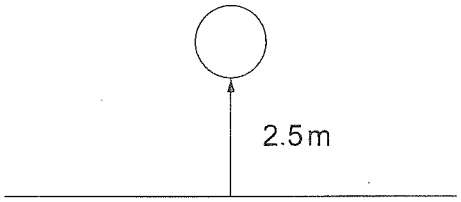
Examiner only

(iii) The ball rebounds to a maximum height of 2.5 m. Calculate how long it takes to reach this height after it rebounds. [3]



$u = 10$
$v = ?\ 0$
$t = ?$
$a = -10\ m/s^2$
$s = 2.5$

$$s = ut + \frac{1}{2}at^2$$

$$2.5 = 10 \times y + \frac{1}{2} \times -10 \times y^2$$

$$\frac{2.5}{10} = y + \frac{1}{2} \times -10 \times y^2$$

$0.25 =$

$$v^2 = u^2 + 2as$$

$$v^2 = 10^2 + 2 \times -10 \times 2.5$$

$$v^2 = \sqrt{50}$$

$$v = 7.07$$

$$v = u + at$$

$$7.07 = 10 + -10 \times t$$

$$\frac{7.07}{10} = -10 \times t$$

0.07

$$v = u + at$$

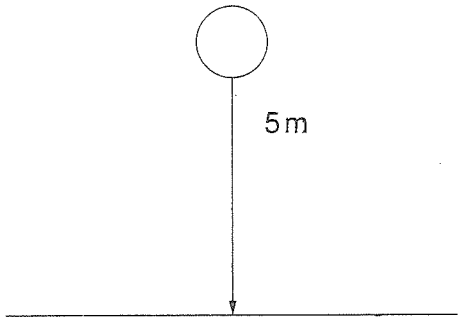
$$0 = 10 + -10 \times t$$

time = 7.07 s

8

Examiner only

5. A ball of mass 0.2 kg, initially at rest, is dropped from a height of 5 m.



Use equations from page 2 to answer the following questions.
Assume acceleration due to gravity = 10 m/s^2 and that air resistance is negligible.

(i) Calculate the speed with which the ball hits the ground. [3]

Speed = $\frac{\text{distance}}{\text{time}}$ speed = $\frac{5}{10}$

time = $\frac{\text{distance}}{\text{speed}}$

speed = 0.5 m/s

(ii) As the ball rebounds it loses **half of its kinetic energy**. Calculate the rebound speed. [2]

$KE = \frac{\text{mass} \times \text{speed}^2}{2}$

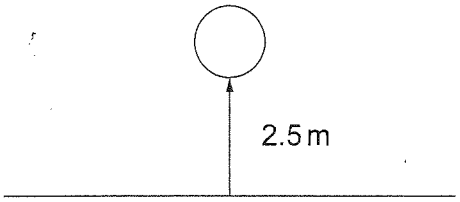
$KE = \frac{0.2 \times 0.5^2}{2}$

$= 0.025 \div 2 = 0.0125$

speed = 0.0125 m/s

Examiner only

(iii) The ball rebounds to a maximum height of 2.5 m. Calculate how long it takes to reach this height after it rebounds. [3]



time = distance / speed

time = 2·5 / 0·0125

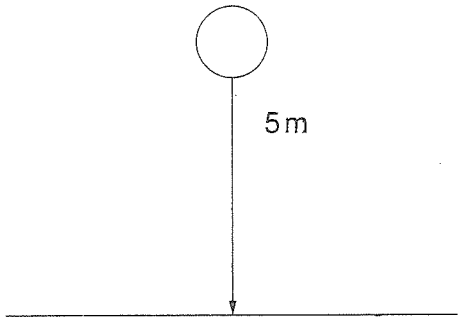
= 200

time = 200 s

8

Examiner only

5. A ball of mass 0.2 kg, initially at rest, is dropped from a height of 5 m.



Use equations from page 2 to answer the following questions.
Assume acceleration due to gravity = 10 m/s^2 and that air resistance is negligible.

(i) Calculate the speed with which the ball hits the ground. [3]

Speed = $\frac{\text{distance}}{\text{time}}$ speed = $\frac{5}{10}$

speed = 0.5 m/s

(ii) As the ball rebounds it loses **half of its kinetic energy**. Calculate the rebound speed. [2]

$KE = \frac{\text{mass} \times \text{speed}^2}{2}$

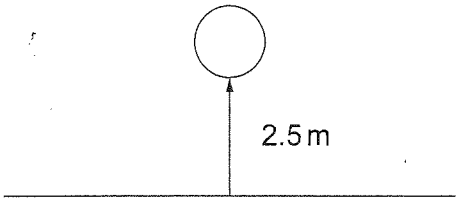
$KE = \frac{0.2 \times 0.5^2}{2}$

$= 0.025 \div 2 = 0.0125$

speed = 0.0125 m/s

Examiner only

(iii) The ball rebounds to a maximum height of 2.5 m. Calculate how long it takes to reach this height after it rebounds. [3]



time = distance / speed

time = 2·5 / 0·0125

= 200

time = 200 s

8

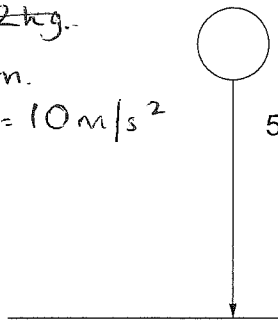
mass

Examiner only

5. A ball of mass 0.2 kg, initially at rest, is dropped from a height of 5 m.

u initial v = 0.
~~mass = 0.2kg.~~
x Height = 5m.
a Acceleration = 10 m/s²

v final velocity?



-9.18

Use equations from page 2 to answer the following questions.
Assume acceleration due to gravity = 10 m/s² and that air resistance is negligible.

(i) Calculate the speed with which the ball hits the ground. [3]

$v^2 = u^2 + 2ax$

$v^2 = 0^2 + 2 \times 10 \times 5$

$v^2 = 100.$

$v = \sqrt{100}$

speed = 10 m/s

(ii) As the ball rebounds it loses **half of its kinetic energy**. Calculate the rebound speed. [2]

kinetic energy = $\frac{\text{mass} \times \text{speed}^2}{2}$

$= \frac{0.2\text{kg} \times 10^2}{2}$

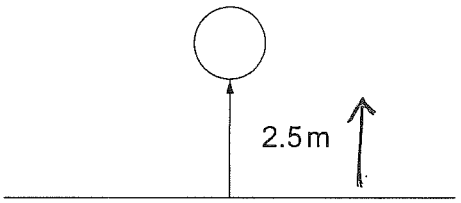
$= 10$

$10 \div 2 = 5$

speed = 5 m/s

Examiner only

(iii) The ball rebounds to a maximum height of 2.5 m. Calculate how long it takes to reach this height after it rebounds. [3]



Speed =

final (v) =

$v = 5$

$u = 0$

$x = 2.5\text{m}.$

$x = \frac{1}{2}(u + v)\,t$

$x = 2.5 = \frac{1}{2}(10 + 5)\,t$

$2.5 = 7.5\,t$

$\frac{2.5}{7.5} = t$

time = 3 s

8

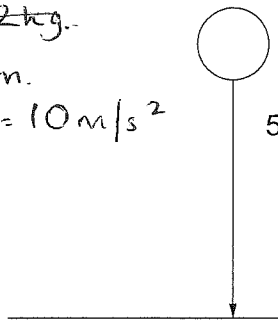
mass

Examiner only

5. A ball of mass 0.2 kg, initially at rest, is dropped from a height of 5 m.

u initial v = 0.
~~mass = 0.2kg.~~
x Height = 5m.
a Acceleration = 10 m/s²

v final velocity?



-9.18

Use equations from page 2 to answer the following questions.
Assume acceleration due to gravity = 10 m/s² and that air resistance is negligible.

(i) Calculate the speed with which the ball hits the ground. [3]

$v^2 = u^2 + 2ax$

$v^2 = 0^2 + 2 \times 10 \times 5$

$v^2 = 100.$

$v = \sqrt{100}$

speed = 10 m/s

(ii) As the ball rebounds it loses **half of its kinetic energy**. Calculate the rebound speed. [2]

kinetic energy = $\frac{\text{mass} \times \text{speed}^2}{2}$

$= \frac{0.2\text{kg} \times 10^2}{2.}$

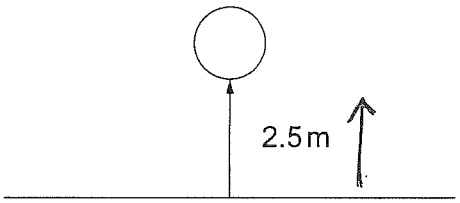
$= 10$

$10 \div 2 = 5$

speed = 5 m/s

Examiner only

(iii) The ball rebounds to a maximum height of 2.5 m. Calculate how long it takes to reach this height after it rebounds. [3]



Speed = final (v) =

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$u = 0$

$x = 2.5\text{m}$.

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$x = 2.5 = \frac{1}{2}(10 + 5)\,t$

$2.5 = 7.5\,t$

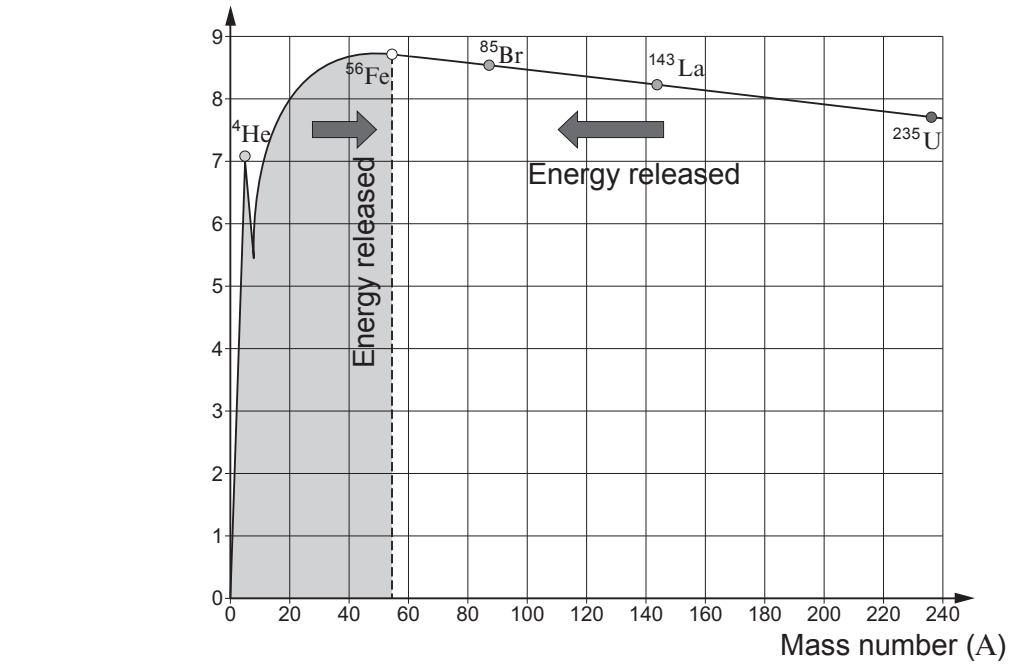
$\frac{2.5}{7.5} = t$

time = 3 s

8

Examiner only

(c) Use the graph below to explain why energy is released in both nuclear fission **and** nuclear fusion. [6 QWC]

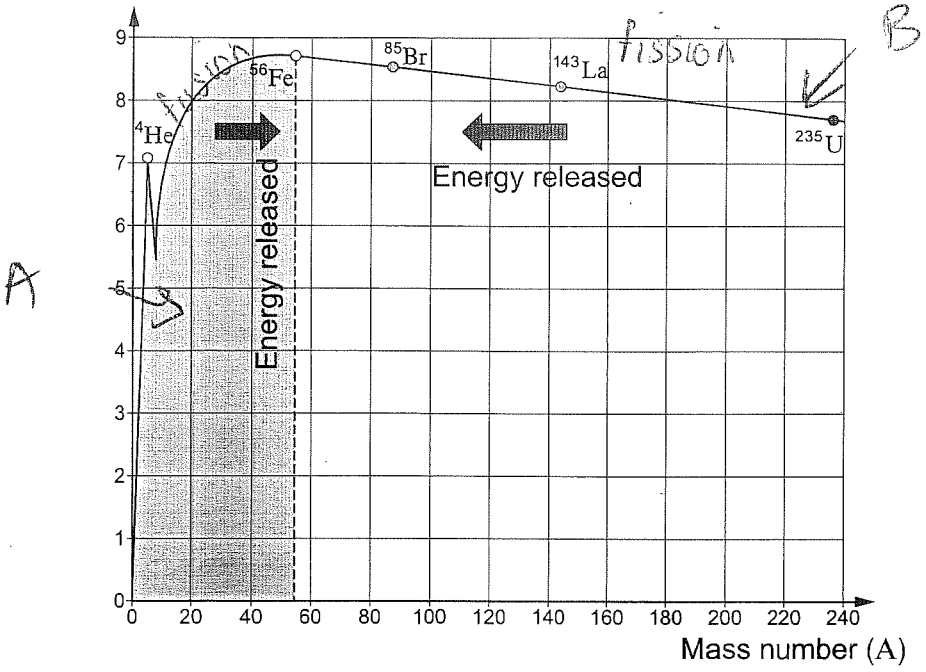


END OF PAPER

Examiner only

6. *(c)* Use the graph below to explain why energy is released in both nuclear fission and nuclear fusion. [6 QWC]

Binding energy per nucleon (MeV)



At nuclear fusion this happens in the sun and it is when all the hydrogen elements have been used up and then helium is fused together which makes a heavier nuclei. Hence on the left hand side of the graph labelled A then the mass number increases. The lighter nuclei fuse together to make heavier nuclei until it reaches Iron which is the most stable. On the other side labelled B fission takes place. For example uranium which is the heaviest with a mass number of 240 will be fired with a slow moving electron to make fission fragments which have a lighter mass number. This will continue to happen until it reaches Iron which is the most stable. In both of the stages energy is released. Iron is the most stable because it has the highest binding energy.

END OF PAPER

Examiner only

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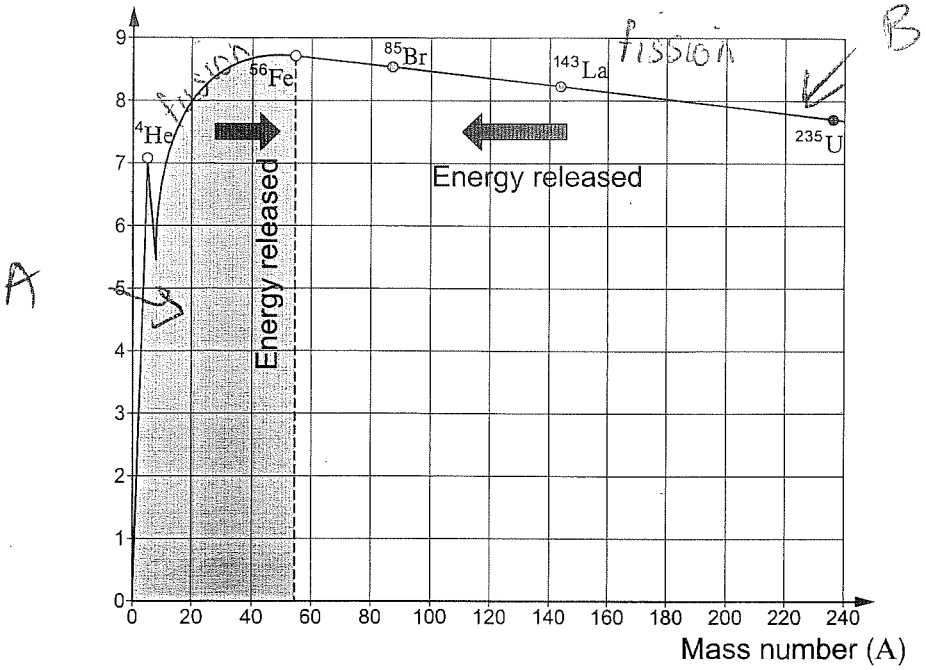

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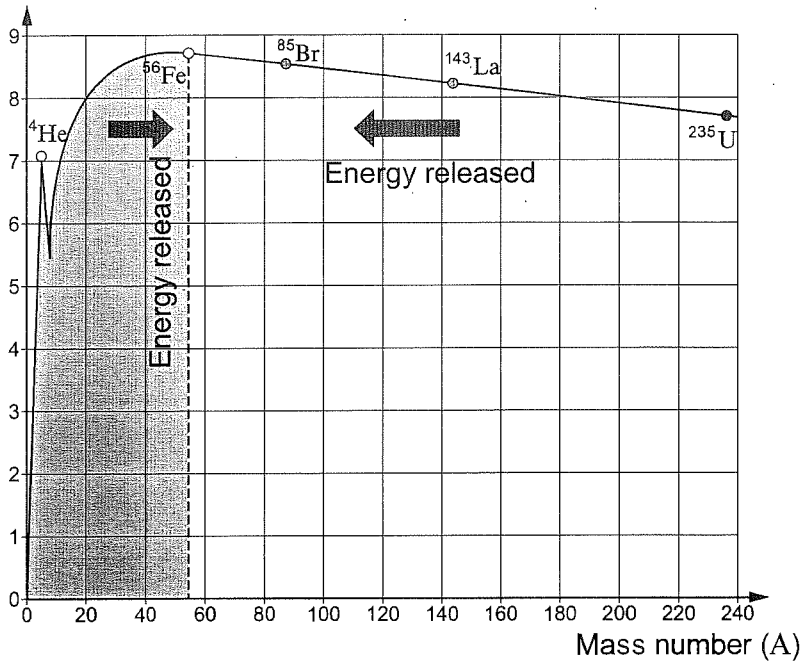

During nuclear fission an unstable nuclei is hit by slow moving neutron and this causes the nuclei to split into two daughter nuclei and release huge amount of energy as well as neutrons. During nuclear ~~fusion~~ fussion high energy collisions between light elements cause fussion and release high amount of energy. During a fusion reaction the elements that are made as a product such as helium in the fussion of hydrogen are ~~now~~ lighter than the reactants. So this mass that is lost is converted to energy because of the equation $E=mc^2$. During fission the mass of the ~~reac~~ products (^{85}Br and ^{147}La) are also lighter then the reactant, ^{235}U, this is because neutrons are released. This mass is again converted to energy because of $E=mc^2$.

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Examiner only

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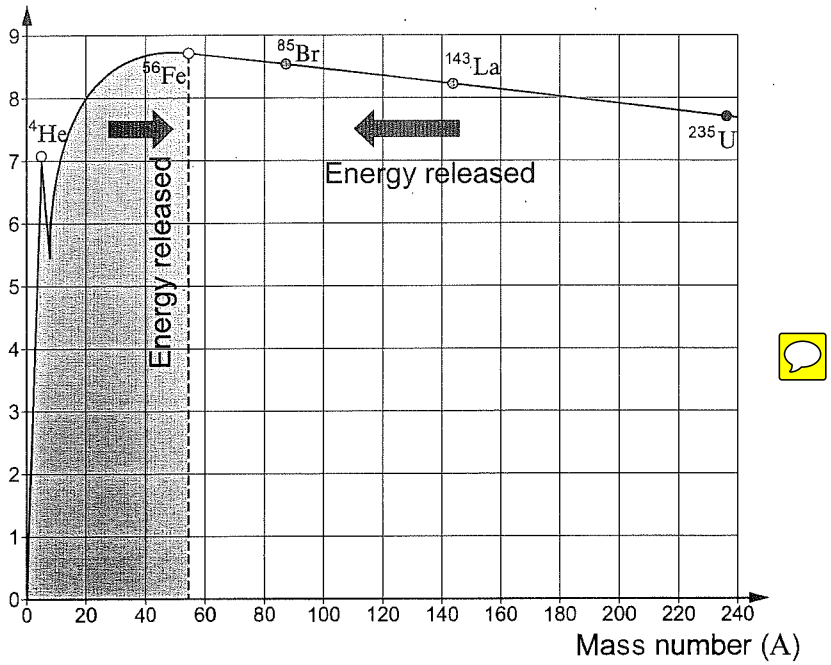

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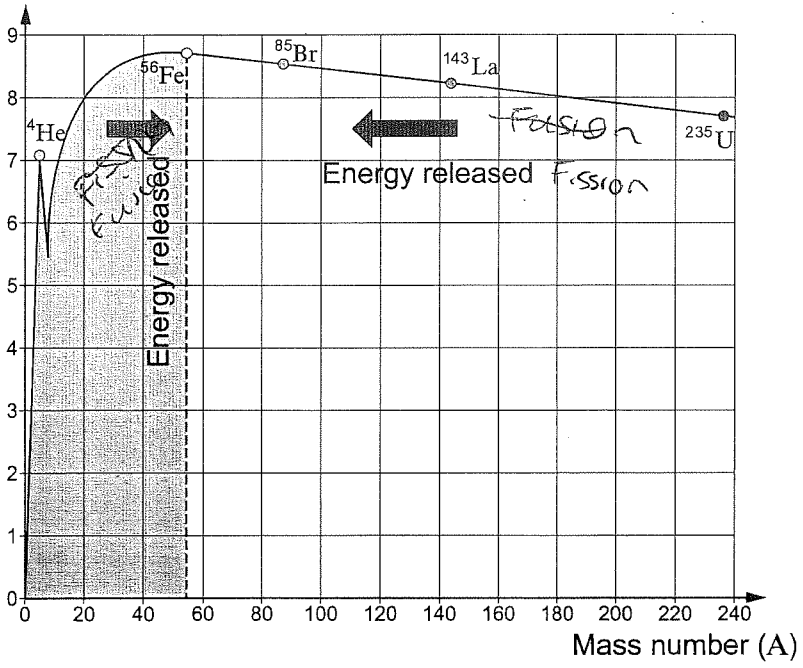

The graph is a binding curve It shows that Iron-56 (^{56}Fe) requires the most binding energy per nucleon Iron-56 is the last element that can be made by fusion Every element previous to this is also made by fusion Therefore the energy released is in the form of a gamma ray or a positron Elements with less than a mass no of 56 are made via fusion The second side of the graph shows that Uranium-235, as all elements beyond Iron-56 are made by fission, they are usually heavier elements. Helium and hydrogen are lighter elements. Fusion generally produces more energy as the mass number increase Fusion cannot create Uranium as the process is designed for lighter elements. It is the same for fission, it requires heavy nuclei

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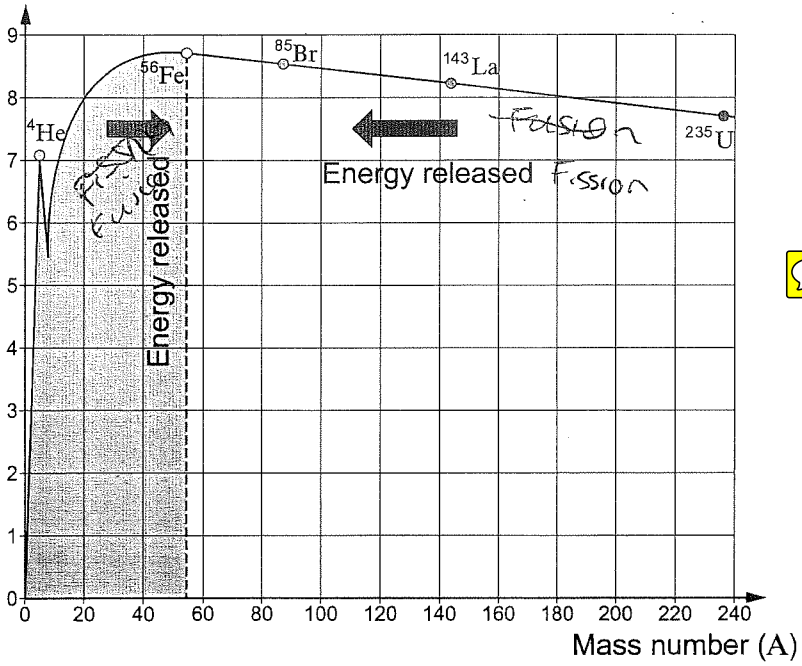

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