UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

6384565621

PHYSICS **0625/33**

Paper 3 Extended **October/November 2013**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
Take the weight of 1 kg to be 10 N (i.e. acceleration of free fall = 10 m/s^2).

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **18** printed pages and **2** blank pages.

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1 An archaeologist digging at an ancient site discovers a spoon. The spoon is made from an unidentified material.

(a) The archaeologist suspects that the spoon is made of metal. She places it above a flame, as shown in Fig. 1.1.

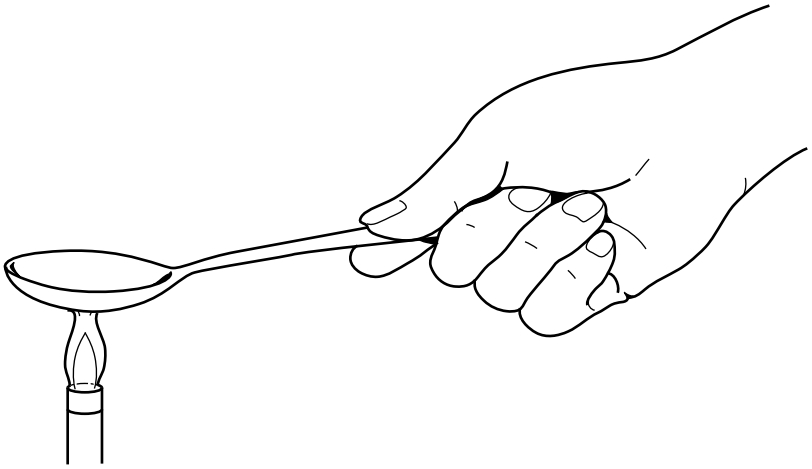


Fig. 1.1

(i) She notices that the handle of the spoon quickly becomes very hot.

State why this observation supports the suggestion that the spoon is made of metal.

.....

..... [1]

(ii) Describe, in terms of its atoms, how thermal energy is transferred through a metal.

.....

.....

.....

.....

..... [3]

(b) The archaeologist hopes that, by determining its density, she will be able to identify the metal.

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Describe a method for determining the density of the metal from which the spoon is made.

.....

.....

.....

.....

.....

.....

.....[4]

[Total: 8]

2 A spring S is suspended from a clamp stand in a school laboratory.

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A student hangs various masses from the end of S and determines the extension x produced by each mass.

(a) Calculate the weight of a 250 g mass.

weight = ... [2]

(b) The student plots a graph of the force F applied to the spring against the extension x. Fig. 2.1 is the student's graph.

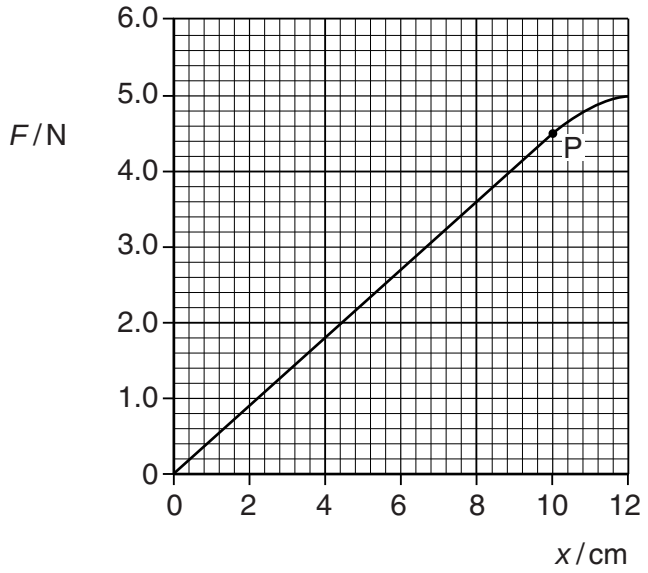


Fig. 2.1

At point P on the graph, the line begins to curve.

(i) State the name given to point P.

.....

.....[1]

(ii) Use the section of the graph where spring S obeys Hooke's law ($F = kx$) to determine the spring constant k of the spring.

k = ... [2]

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(c) Fig. 2.2 shows a mass of 0.12 kg resting on the bottom of a box.

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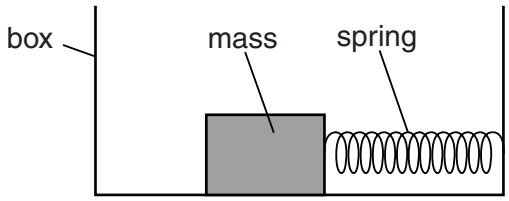


Fig. 2.2

A spring that is identical to S connects the mass and one side of the box. Ignore friction between the mass and the box.

(i) The box and the mass are at rest.

State the resultant force acting on the mass.

force = ... [1]

(ii) The box is firmly attached, in a horizontal position, to the body of a racing car.

As the car accelerates the spring stretches by 2.0 cm.

1. Using Fig. 2.1, determine the tension in the spring.

tension = ... [1]

2. Calculate the acceleration of the mass produced by this tension.

acceleration = ... [2]

[Total: 9]

3 Fig. 3.1 shows a fork-lift truck lifting a crate on to a high shelf in a warehouse.

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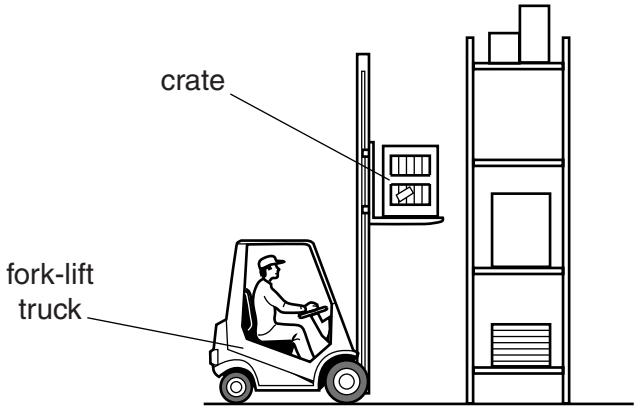


Fig. 3.1

The fork-lift truck lifts a crate of weight 640 N through a vertical distance of 3.5 m in 4.0 s.

(a) Calculate the useful work done in lifting the crate.

work done = ... [2]

(b) A motor drives a mechanism to lift the crate. The current in the motor is 25 A. The motor is connected to a 75 V battery.

Calculate

(i) the energy supplied to the motor in 4.0 s,

energy = ... [2]

(ii) the overall efficiency of the fork-lift truck in lifting the crate.

efficiency = ... [2]

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(c) Not all of the energy supplied is used usefully in lifting the crate.

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Suggest two mechanisms by which energy is wasted.

1. .....

2. ..... [2]

[Total: 8]

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4 A child's toy launches a model parachutist of mass 0.40 kg vertically upwards. The model parachutist reaches a maximum height of 8.5 m.

(a) Calculate

(i) the gravitational potential energy gained by the model parachutist,

energy = ... [2]

(ii) the minimum possible speed with which the model parachutist was launched.

speed = ... [3]

(b) In practice, the launch speed must be greater than the value calculated in **(a)(ii)**.

Explain why.

.....

.....

..... [2]

(c) As the model parachutist returns to the ground, it loses gravitational potential energy.

Explain what happens to this energy as the model parachutist falls through the air at constant speed.

.....

..... [1]

[Total: 8]

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5 The Sun is a large sphere of high temperature gas. An extremely large quantity of energy radiates from the Sun into space every second.

(a) A process releases energy inside the Sun and its temperature stays high.

State the name of this process.

..... [1]

(b) A gardener stores water in a large, cylindrical metal drum. The drum is painted black and has no lid. On a bright, sunny day, the water evaporates quickly and the water level in the drum falls.

(i) Suggest how, by using a drum of a different shape, the gardener can reduce the quantity of water lost by evaporation.

.....

..... [1]

(ii) The gardener is told that, by painting the drum white, he can reduce the quantity of radiation absorbed and so reduce the rate of evaporation.

Describe an experiment to show that black surfaces are better absorbers of radiation than white surfaces. You may include a diagram.

.....

.....

.....

.....

..... [4]

[Total: 6]

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6 A student uses a 2400W electric kettle to obtain a value for the specific heat capacity of sunflower oil.

Fig. 6.1 shows the apparatus.

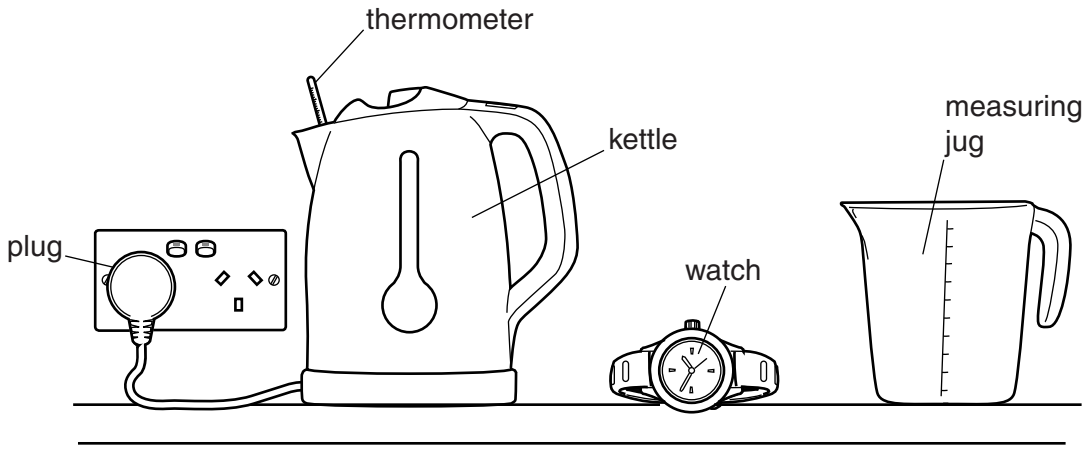


Fig. 6.1

The student uses a measuring jug and pours 1.5 kg of sunflower oil into the empty kettle. He uses a thermometer to measure the temperature of the oil.

The kettle is switched on and left on for 50 s. The temperature of the oil increases by 32 °C.

The student assumes that all the electrical energy is transferred as thermal energy to the oil.

(a) Calculate the value for the specific heat capacity of sunflower oil obtained by the student.

specific heat capacity = ... [4]

(b) State and explain whether the value for the specific heat capacity obtained by the student is too large or too small.

.....

..... [1]

[Total: 5]

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7 A ray of light from a laser passes from air into a clear, semi-circular, plastic block. Fig. 7.1 shows the ray entering the block.

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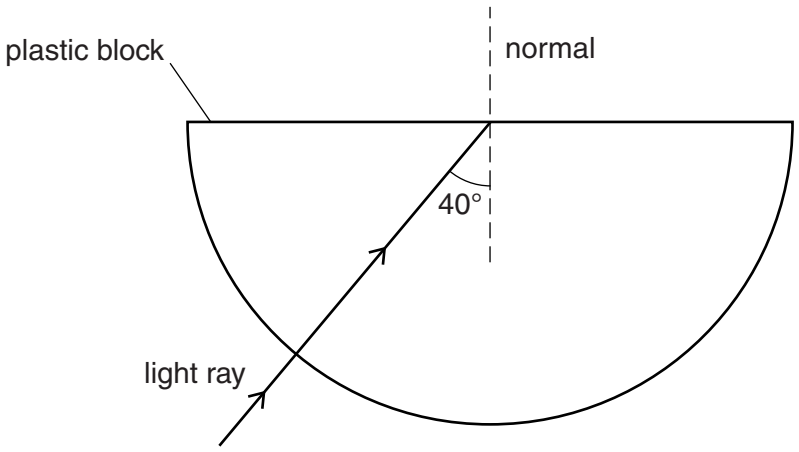


Fig. 7.1

The ray continues in the same direction and meets the middle of the opposite surface at an angle of 40° to the normal. The refractive index of the plastic is 1.5.

(a) The ray continues into the air.

Calculate the angle between the normal and the path taken by the light after it leaves the block.

angle = ... [3]

(b) The frequency of the light produced by this laser is 3.8×10^{14} Hz and its wavelength in the plastic block is 5.3×10^{-7} m (0.000 53 mm).

For Examiner's Use

Calculate

(i) the speed of light in this plastic,

speed = ... [2]

(ii) the speed of light in air.

speed = ... [2]

(c) Explain why the ray does not change direction as it enters the plastic block.

.....

.....

.....[2]

[Total: 9]

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8 An a.c. power supply is connected in series with a metal-filament lamp. A cathode-ray oscilloscope (c.r.o.) is in parallel with the lamp, as shown in Fig. 8.1.

Fig. 8.2 is the trace seen on the c.r.o. screen.

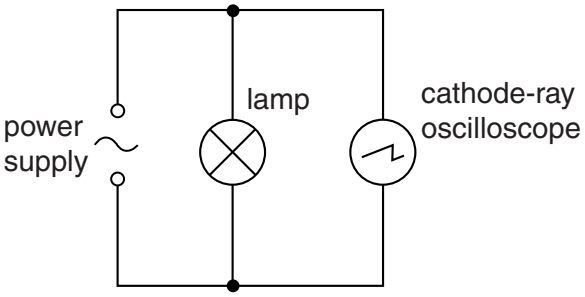


Fig. 8.1

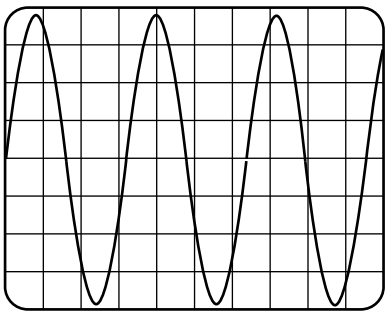


Fig. 8.2

A diode is inserted in the circuit, as shown in Fig. 8.3.

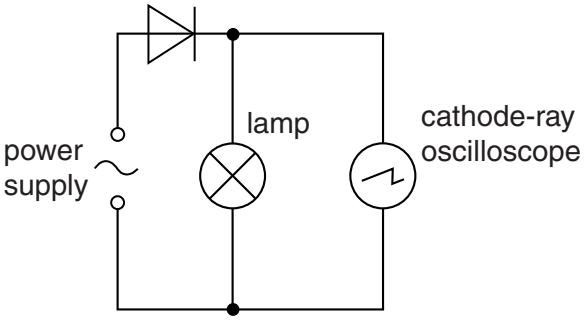


Fig. 8.3

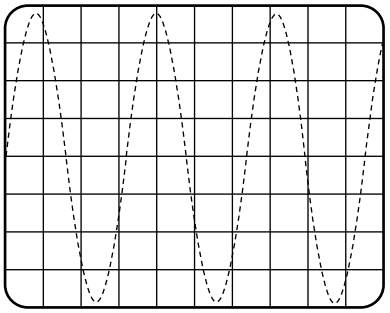


Fig. 8.4

(a) (i) On Fig. 8.4, draw the shape of the trace now seen on the screen. [2]

(ii) Suggest a device that uses a diode in this way.

..... [1]

(b) State and explain the effect on the lamp of inserting the diode into the circuit.

.....

.....

..... [2]

[Total: 5]

9 The a.c. supply from a power station is connected to the primary coil of a transformer. The secondary coil is connected to long-distance transmission cables.

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(a) The output voltage of the transformer is greater than the input voltage.

Explain how a transformer produces this output voltage.

.....

.....

.....

.....

.....

..... [4]

(b) There are energy losses in the transmission cables.

(i) Explain why the energy losses become greater when the length of the transmission cables is greater.

.....

.....

..... [2]

(ii) Discuss the advantages and disadvantages of using transmission cables of greater cross-sectional area.

.....

.....

..... [2]

[Total: 8]

10 Fig. 10.1 shows a variable resistor (rheostat) and a solenoid (long coil) connected to a battery.

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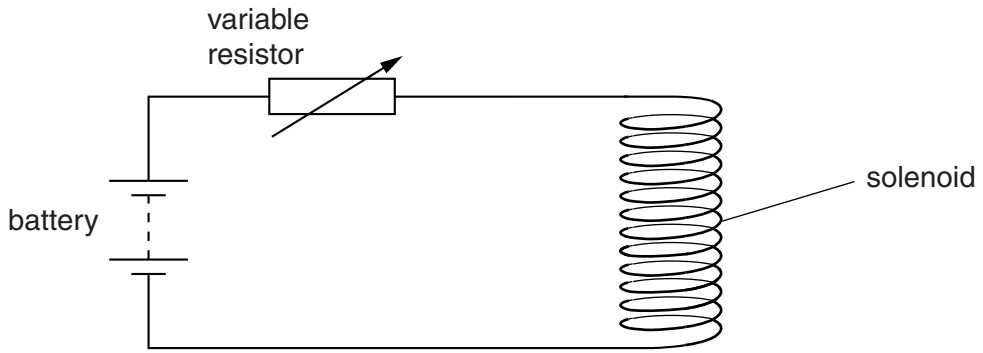


Fig. 10.1

The current in the solenoid produces a magnetic field.

(a) (i) On Fig. 10.1, draw lines to show the pattern of the magnetic field due to the current. [2]

(ii) State the feature of the pattern of the magnetic field lines that indicates the strength of the magnetic field at particular points.

.....

..... [1]

(b) State and explain the effect on the magnetic field of increasing the resistance of the variable resistor.

.....

.....

.....

..... [2]

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(c) In a laboratory vacuum chamber, some current-carrying coils produce a very strong magnetic field near a source of α-particles.

Fig. 10.2 shows the arrangement.

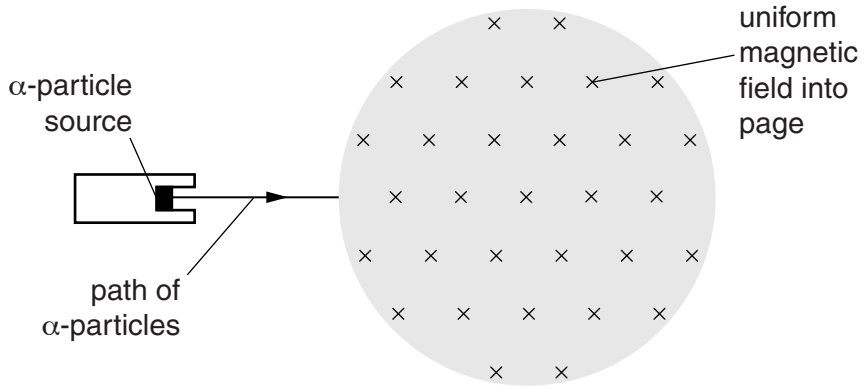


Fig. 10.2

(i) In the shaded region of Fig. 10.2, draw a possible path for the α-particles in the magnetic field. [2]

(ii) State and explain the effect on this path of reversing the current in the coils.

.....

.....

..... [2]

[Total: 9]

11 In a laboratory at a nuclear power station, a radiation detector is connected to a computer. The readings recorded are displayed on the computer screen.

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The detector is switched on. Ten minutes later, at time t = 10 minutes, a small sample of radioactive material is removed from a nuclear reactor and placed near to the detector. Readings are recorded for a further 40 minutes. Fig. 11.1 shows the display.

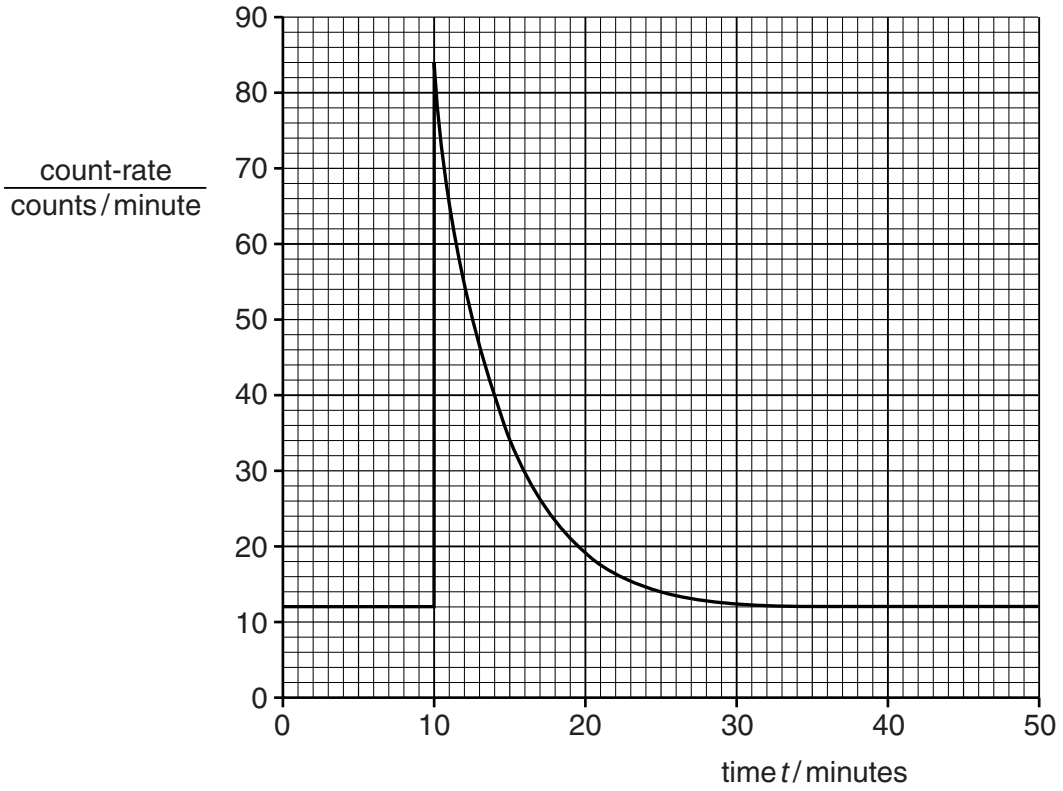


Fig. 11.1

(a) Use Fig. 11.1 to determine the background count-rate in the laboratory.

background count-rate = ... [1]

(b) Use Fig. 11.1 to determine the count-rate due to the radioactive sample

(i) at t = 10 minutes,

count-rate due to sample = ...

(ii) at t = 19 minutes.

count-rate due to sample = ...
[2]

(c) Use the values obtained in **(b)** to estimate the half-life of the radioactive sample.

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half-life = ... [2]

[Total: 5]

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