UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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7656704974

PHYSICS **0625/32**

Paper 3 Extended **October/November 2011**

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, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
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 Fig. 1.1 shows a simple pendulum being used by a student to investigate the energy changes at various points in the pendulum's swing.

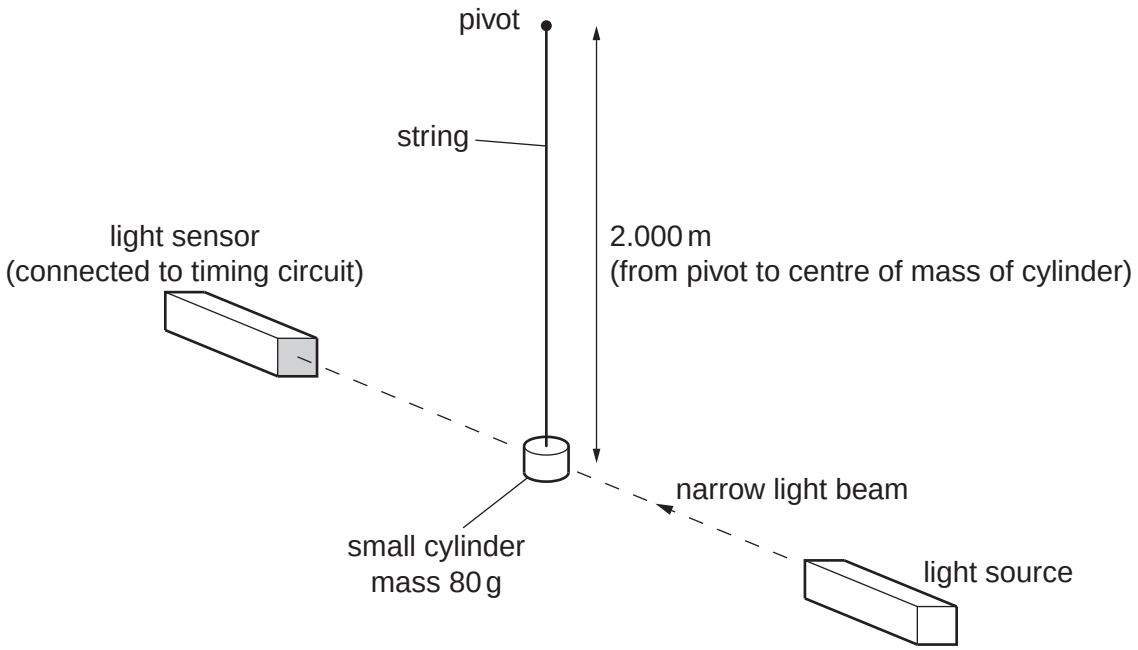


Fig. 1.1

(a) When the string is displaced by a small angle from the vertical, the height of the cylinder changes so that its centre of mass is now 1.932 m below the pivot. Determine the gravitational potential energy gained by the cylinder. Use $g = 10\,m/s^2$.

gravitational potential energy gained = ... [3]

(b) The cylinder is released from the displaced position in **(a)**. Calculate the expected speed of the cylinder when the string is vertical.

expected speed = ... [2]

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(c) As the string passes through the vertical, the narrow beam of light is interrupted by the cylinder for 22 ms. The cylinder has a diameter of 2.5 cm.

(i) Calculate the actual speed of the cylinder.

actual speed = ...

(ii) Suggest how the difference between the actual and expected speeds could occur.

.....

.....

.....

.....

[3]

[Total: 8]

2 The racing car shown in Fig. 2.1 uses a Kinetic Energy Recovery System (KERS). This system stores within the car some of the kinetic energy lost when the car slows down for a corner. The driver can later release the stored energy when maximum power is required.

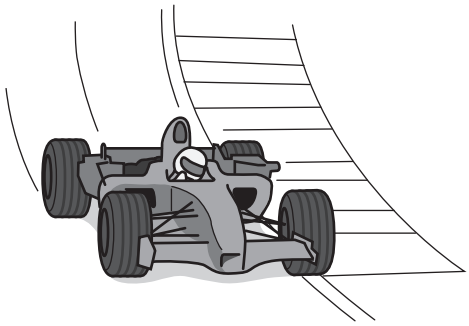


Fig. 2.1

(a) The car approaches a corner and decelerates from 82 m / s to 61 m / s in 0.90 s. Calculate the deceleration.

deceleration = ... [2]

(b) **(i)** The energy lost during the braking in **(a)** is 8.4×10^5 J. 40% of this lost energy is directed to the KERS system. Determine the amount of energy stored.

energy stored = ...

(ii) The driver later uses all of this stored energy to give 60 kW of useful extra power for 3.0 s. Calculate the energy released.

energy released = ...

(iii) Calculate the efficiency of the KERS system.

efficiency = ...
[4]

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(c) Suggest a possible device to store energy when a moving vehicle slows down. For this device, state the change that occurs as more energy is stored.

device .....

change .....

.....

..... [2]

[Total: 8]

3 Fig. 3.1 shows a house brick of dimensions 21.0 cm × 10.0 cm × 7.00 cm.

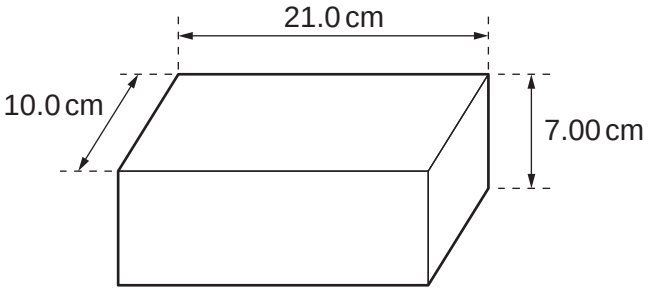


Fig. 3.1

The brick is held under water with its largest surfaces horizontal. The density of water is 1000 kg / m^3.

(a) Calculate the difference in pressure between the top and the bottom surfaces of the brick.

pressure difference = ... [2]

(b) Use your value from **(a)** to calculate the upward force exerted on the brick by the water.

upward force = ... [2]

(c) The mass of the brick is 3.09 kg. Calculate the acceleration of the brick when it is released.

acceleration = ... [3]

[Total: 7]

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4 A sealed balloon containing some helium gas is released and rises into the upper atmosphere. As the balloon rises the temperature of the helium falls and the balloon expands.

Explain, in terms of atoms,

(a) the effect of the fall in temperature on the helium pressure,

.....

.....

.....

.....

..... [3]

(b) the effect of the expansion of the balloon on the helium pressure.

.....

.....

.....

.....

..... [3]

[Total: 6]

5 Fig. 5.1 shows an X-ray tube.

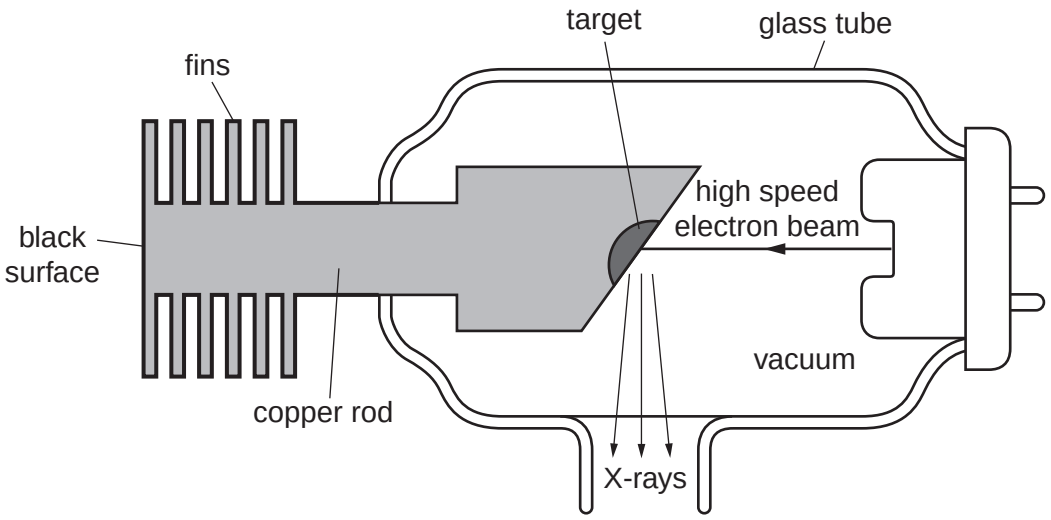


Fig. 5.1

In the production of X-rays, the target gets very hot. Thermal energy must be removed from the target. The tube has several design features to enable this to happen.

For each of the following types of energy transfer, describe how the design of the tube increases the rate of energy transfer. State where the thermal energy transfer mostly happens, the particular design feature that increases the rate of this transfer, and a brief explanation.

(a) conduction

where .....

design feature .....

explanation .....

..... [3]

(b) convection

where .....

design feature .....

explanation .....

..... [3]

(c) radiation

where .....

design feature .....

explanation .....

..... [3]

[Total: 9]

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6 Fig. 6.1 shows an enlarged view of a spherical raindrop, centre O.

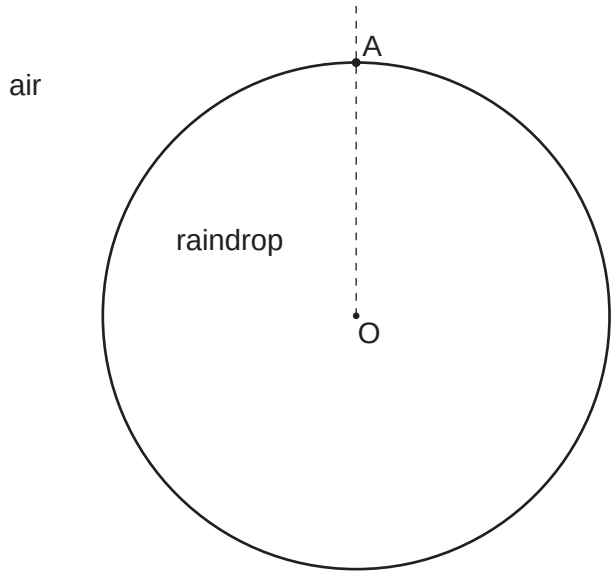


Fig. 6.1

(a) On Fig. 6.1, draw a ray in the air striking the raindrop at A with an angle of incidence of 59° and coming from the left. [1]

(b) The water in the raindrop has a refractive index of 1.33.

(i) Show by calculation that the angle of refraction at A is about 40°.

[2]

(ii) On Fig. 6.1, draw the path of the refracted ray to the point where it strikes the inner surface of the raindrop. Label this point B. [1]

(c) The ray is partially reflected at B.
Draw the normal and the reflected ray at B. [1]

(d) Extend the reflected ray to strike the surface of the raindrop again. At this point it is partially refracted out of the raindrop. Draw the approximate path of this ray as it emerges into the air. [1]

[Total: 6]

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7 **(a)** State an approximate value for

(i) the speed of sound in air, ...

(ii) the speed of light in air. ..... [2]

(b) Use your value from **(a)(i)** to calculate the frequency of a sound wave that has a wavelength of 1.2 m.

frequency = ... [2]

(c) A meteorologist observes an approaching thunderstorm and records a time difference of 4.8 s between seeing a lightning flash and hearing the thunder that follows.

(i) Calculate the distance of the thunderstorm from the meteorologist.

distance = ...

(ii) State an assumption you made when calculating this distance.

.....

.....

.....
[2]

[Total: 6]

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8 Fig. 8.1 shows a loudspeaker cone oscillating to produce sound waves.

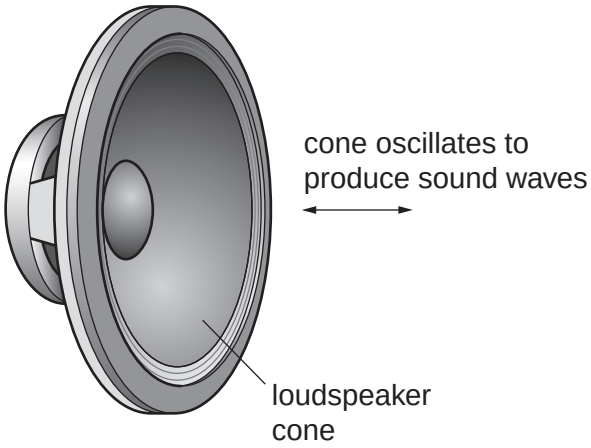


Fig. 8.1

(a) As the sound wave passes a point, it produces regions of higher and lower pressure. State the names of these regions.

higher pressure .....

lower pressure ..... [2]

(b) Describe how the movement of the loudspeaker cone produces these regions of different pressure.

higher pressure .....

.....

lower pressure .....

..... [2]

(c) State the effect on the loudness and pitch of the sound from the loudspeaker when

(i) the amplitude increases but the frequency of the sound stays the same,

loudness .....

pitch .....

(ii) the amplitude stays the same but the frequency increases.

loudness .....

pitch .....

[2]

[Total: 6]

9 Fig. 9.1 shows a circuit containing a battery, three resistors and an ammeter.

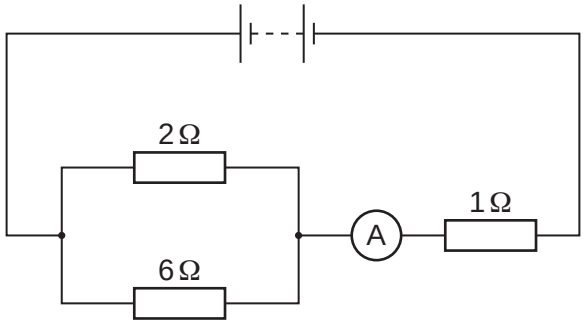


Fig. 9.1

(a) **(i)** Write down the equation for the effective resistance R_p of two resistors of resistances R_1 and R_2 connected in parallel.

(ii) Use this equation to calculate the effective resistance of the two resistors in parallel in Fig. 9.1.

effective resistance = ... [2]

(b) A voltmeter is to be used to measure the potential difference across the resistors in parallel.

(i) On Fig. 9.1, draw the voltmeter in position in the circuit, using the correct circuit symbol.

(ii) The ammeter reads 1.6 A. Calculate the reading on the voltmeter.

voltmeter reading = ... [3]

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(c) State what happens to the ammeter reading if the 1 Ω resistor is replaced by a 3 Ω resistor.

.....

..... [1]

[Total: 6]

10 The circuit shown in Fig. 10.1 was designed by an electronics student to provide a warning, by sounding the buzzer, that there is light in a photographic darkroom at times when it is in use.

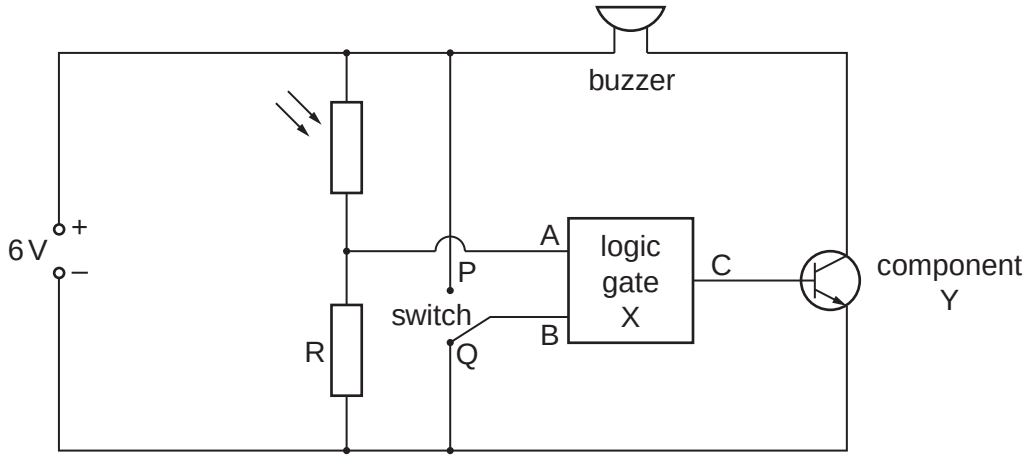


Fig. 10.1

When the darkroom is in use the switch is moved to position P. When it is not in use, the switch is in position Q.
Depending upon the light level, the resistance of the light dependent resistor varies between much higher and much lower than the resistance of resistor R.

(a) State what happens to the resistance of the light dependent resistor when the light level changes from dark to light.

.....

..... [1]

(b) Write down whether the voltage level is high (logic 1) or low (logic 0) at the various points in the circuit in the following situations:

(i) at A light in the darkroom, ...

dark in the darkroom, ...

(ii) at B switch in position P, ...

switch in position Q. ..... [2]

(c) The output C of logic gate X is only high (logic 1) when both inputs A and B are high (logic 1). State which type of gate is logic gate X.

..... [1]

(d) State the name of component Y.

..... [1]

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(e) Explain whether or not the student's circuit achieves the aim of providing a warning that there is light in the darkroom when it is in use.

.....

.....

.....

..... [2]

[Total: 7]

11 In the laboratory demonstration shown in Fig. 11.1, a copper rod rolls at a steady speed down the sloping parallel copper rails. The rails are in the region of a strong magnetic field that acts vertically downwards.

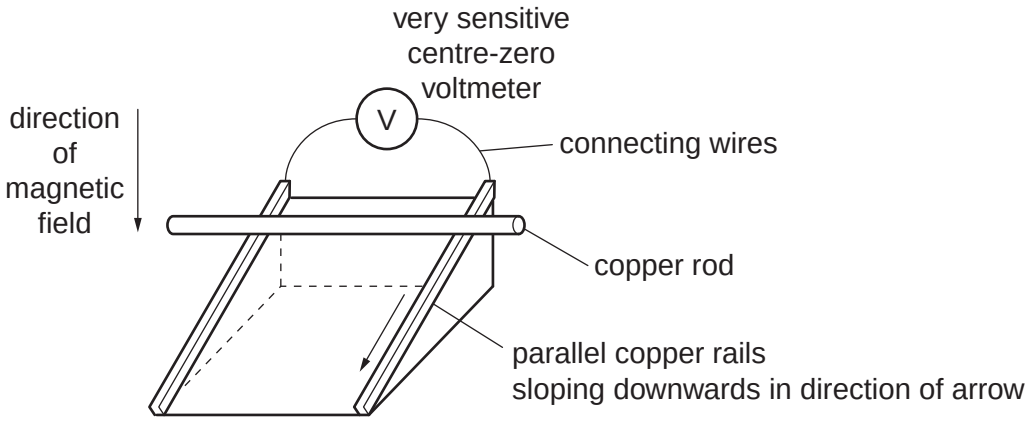


Fig. 11.1

(a) Explain why the voltmeter shows a deflection.

.....

.....

.....

..... [2]

(b) State, with reasons, the effect on the voltmeter deflection of the following changes:

(i) increasing the strength of the magnetic field,

deflection .....

reason .....

.....

.....

(ii) slightly increasing the slope of the copper rails,

deflection .....

reason .....

.....

.....

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(iii) changing the direction of the magnetic field so it is parallel to the copper rails and directed down the slope.

deflection .....

reason .....

.....

.....
[4]

[Total: 6]

12 The most abundant stable isotope of strontium is strontium-88. Its nucleon number is 88 and its proton number is 38. In nuclide notation it is written $^{x}_{y}Sr$.

(a) Write down

(i) the values of x and y for strontium-88, x = ...

y = ...

(ii) the number of neutrons in a nucleus of strontium-88, ...

(iii) the number of electrons in a neutral atom of strontium-88. .....

[3]

(b) Strontium-90 is a radioactive isotope produced by nuclear reactions. State how the structure of this isotope differs from that of strontium-88.

.....

.....

.....

.....

..... [2]

[Total: 5]

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