Cambridge IGCSE

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME **SOLVED BY SMART EXAM RESOURCES**

CENTRE NUMBER | | | | | | CANDIDATE NUMBER | | | | |

PHYSICS **0625/43**

Paper 4 Theory (Extended) **May/June 2019**

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 an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, 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 1.0 kg to be 10 N (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 syllabus is regulated for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

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

DC (RW/SW) 169311/4

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1 Fig. 1.1 shows a distance-time graph for a cyclist travelling between points P and V on a straight road.

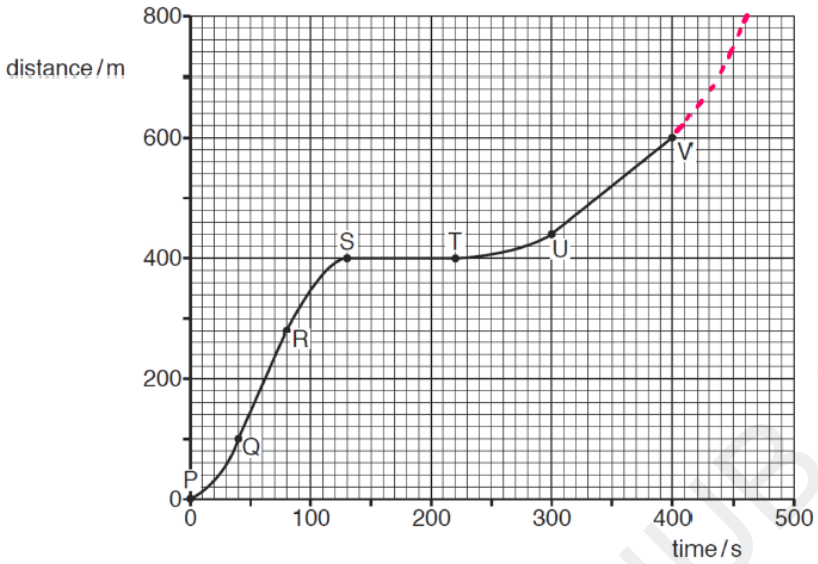


Fig. 1.1

(a) Describe the motion between:

Q and R Constant velocity[or] Constant speed

R and S Deceleration [or] Negative acceleration

S and T. Stationary

[3]

(b) Calculate the speed between U and V.

$$\text{Velocity} = \frac{\text{distance}}{\text{time}} = (600-440)/(400-300) = 160/100 = 1.6$$

Note : You may also state that:
Velocity=Gradient of the UV , followed by the above calculation

1.6m/s

speed = ... [2]

(c) After point V, the straight road continues down a steep hill. The cyclist travels down the steep hill. He does not apply the brakes and all resistive forces can be ignored.

On Fig. 1.1, sketch a possible motion for the cyclist after V. [1]

[Total: 6]

2 Fig. 2.1 is the top view of a small ship of mass 1.2×10^6 kg. The ship is moving slowly sideways at 0.040 m/s as it comes in to dock.

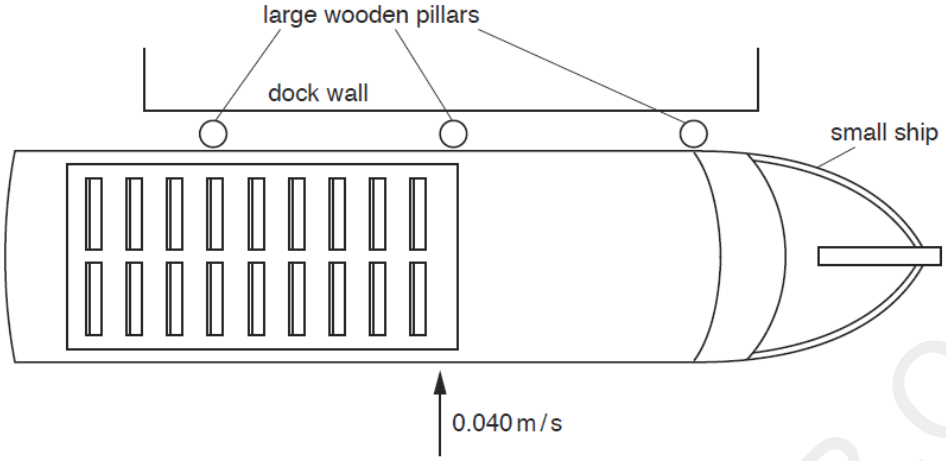


Fig. 2.1

The ship hits the wooden pillars which move towards the dock wall.

(a) Calculate the kinetic energy of the ship before it hits the pillars.

$KE = 1/2\ mv^2$
$(KE) = 1/2 \times 1.2 \times 10^6 \times 0.04^2$

$(KE =) 960\ J$

kinetic energy = 980J ..... [2]

(b) The ship is in contact with the pillars for 0.30 s as it comes to rest.

Calculate the average force exerted on the side of the ship.

METHOD :1

Change in momentum = mv
$= 1.2 \times 10^6 \times 0.04$
$(=) 4.8 \times 10^4$ (kg m/s)

Change in momentum = Ft

Force = Change in momentum / Time
Hence: Force= $4.8 \times 10^4 / 0.3$
$= 1.6 \times 10^5$ N

OR

$a = (v-u)/t$
$= (0.04-0)/0.3$
$= 0.13\ (m/s^2)$
$F = ma$
Force = $1.2 \times 10^6 \times 0.13$
$= 1.6 \times 10^5$ N

force = $1.6 \text{ X } 10^5$N ..... [4]

(c) Assume that the kinetic energy calculated in **(a)** is used to do work moving the pillars.

Calculate the distance moved by the pillars.

Work done or KE transferred = Fd in any form

Distance = 960 / 1.6×10^5
= 6.0×10^{-3} m
[OR]= 0.006 m
[OR]0.60 cm

distance = 0.060cm ..... [2]

(d) Dock walls sometimes have the pillars replaced with rubber car tyres.

Explain how this reduces the possibility of damage when a boat docks.

There is a smaller force on the dock because it increases the time of collision.....

.....

..... [1]

[Total: 9]

3 Fig. 3.1 shows a small submarine submerged below the surface of the sea.

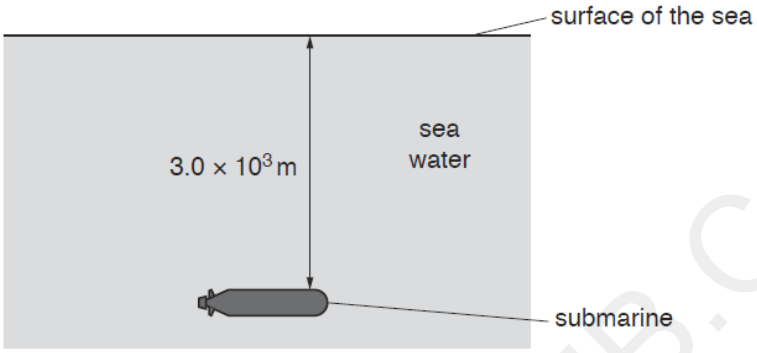


Fig. 3.1

(a) The density of sea water is 1030 kg / m^3.

Calculate the pressure due to the sea water on the top of the submarine when it is 3.0 × 10^3 m below the surface.

p = ρgh in any form

(p=) 1030 × 10 × 3.0 × 10^3

=89000 (J)

pressure = 89000J ..... [2]

(b) The submarine emits a pulse of sound to detect other objects in the sea. The speed of sound in sea water is 1500 m/s. An echo is received with a time delay of 0.50 s after the original sound is emitted.

(i) Calculate the distance between the submarine and the other object.

$v = 2d/t$

$1500 = \frac{2d}{0.50}$

Note: Since the echo is being received, we need to take the distance as 2d as an echo is the reflected sound .

$2d = 1500 \times 0.50$

$d = (1500 \times 0.50)/2$

Hence: d=380 m

distance = 330m [3]

(ii) Another pulse of sound is emitted through the air when the submarine is on the surface.

An echo is received from a second object that is in the air. This echo is received 0.50 s after the pulse of sound is emitted.

Compare the distance of the second object from the submarine with the distance calculated in **(b)(i)**. Tick **one** box. Give a reason for your answer.

distance is smaller ☑

distance is the same ☐

distance is larger ☐

Reason Speed of sound is lower in air than liquid [1]

[Total: 6]

4 **(a)** Water molecules escape to the atmosphere from water boiling in a pan. Water molecules evaporate from the surface of a bowl of cool water and also escape to the atmosphere.

State **two** ways in which boiling is different from evaporation.

In boiling, the bubbles form throughout the liquid

1. .....

.....

Boiling only occurs at one temperature

2. ..... [2]

Also accepted, Boiling does not produce cooling [or] Boiling is not affected by surface area/draught/ humidity [or] It does not lower the kinetic energy of molecules left in the liquid

(b) Fig. 4.1 shows a heater in a metal block.

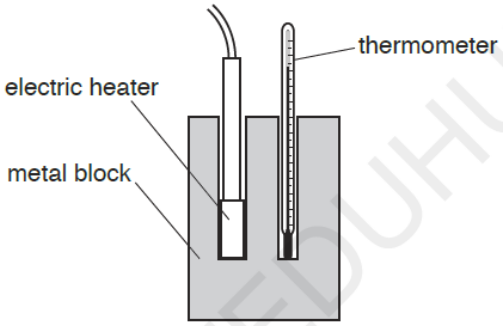


Fig. 4.1

The power of the heater is 370 W and it is switched on for 4.0 minutes. The metal block has a specific heat capacity of 420 J / (kg °C) and a mass of 5.0 kg.

Calculate the increase of temperature of the block. Assume all the thermal energy from the heater is transferred to the block.

$E = P \times t$

$E = 370 \times 240$

$= 89000$ (J)

$E = mc\Delta T$

Hence ;

$\Delta T = E/mc$

Hence;

Temperature increase

$= 89\,000 / \{5.0 \times 420\}$

$= 42$ °C

Note:
While calculating Energy in joules,use the power in watts and time in seconds. Hence convert the time from minutes to seconds.
Thus 4 minutes= 4 x 60= 240s

temperature increase = 42^0C ..... [4]

[Total: 6]

5 Fig. 5.1 shows a cross-section of the inside of a vacuum flask containing a cold liquid. The walls of the vacuum flask are made of glass.

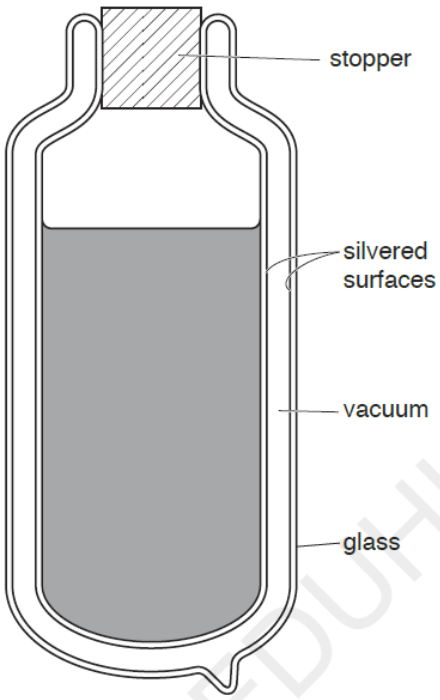


Fig. 5.1

(a) The vacuum flask is being used to keep a liquid cool on a hot day.

Explain how the labelled features of the vacuum flask keep the liquid cool by reducing thermal energy transfer. Include the names of the processes involved.

1. The silvered surfaces are poor emitters and poor absorbers and good reflectors of infra-red radiations.
2. Glass is a poor conductor
3. Vaccuum prevents gain of thermal energy by conduction or convection
4. The stopper prevents the gain of thermal energy by convection

..... [5]

(b) Suggest a suitable material for the stopper.

Cork [or] Plastic [Or} Rubber

..... [1]

[Total: 6]

6 **(a)** Fig. 6.1 shows wavefronts of a wave approaching a narrow gap and passing through the gap. The wavelength is λ.

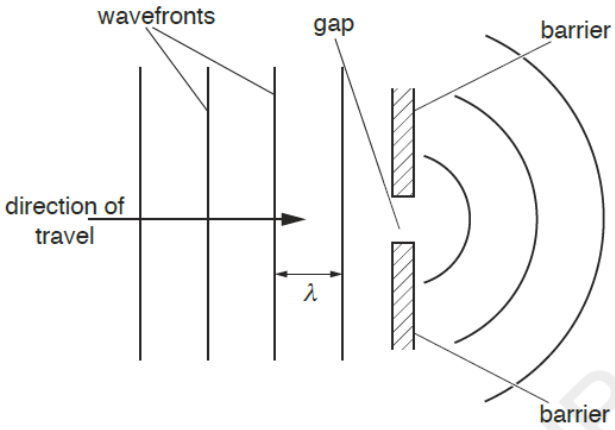


Fig. 6.1

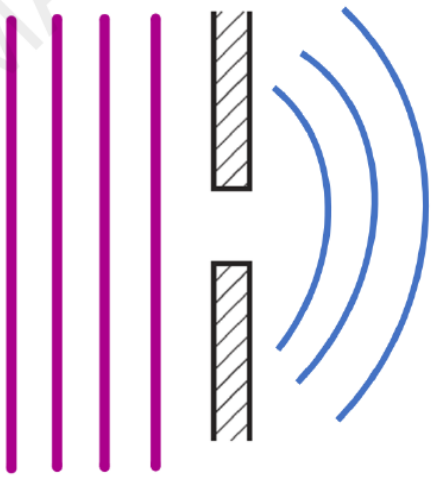
(i) State the name of the process that occurs as the wave passes through the gap.

Diffraction

..... [1]

(ii) A wave with a wavelength $\frac{\lambda}{2}$ approaches the same gap.

On Fig. 6.2, draw three wavefronts for this wave as it approaches the gap and three more wavefronts as the wave continues beyond it. [3]



(b) Table 6.1 shows 5 different types of electromagnetic wave.

In the blank column in Table 6.1, write the numbers 1 to 5 to show the order of wavelength. Write 1 for the wave with the shortest wavelength and 5 for the wave with the longest wavelength. [2]

Table 6.1

type of electromagnetic wave	order of wavelength
gamma rays	1
light	4
microwaves	5
ultraviolet	3
X-rays	2

(c) (i) State the speed of radio waves in air.

3×10^8 m/s ..... [1]

(ii) A radio station transmits radio waves with a frequency of 96 MHz.
Calculate the wavelength of these radio waves.

$v = f\lambda$ .....Equation---1..
Hence: ($\lambda = v/f$).....E2Equation---2

$f = 96 \times 10^6$ Hz

Substituting f and λ in the equation 2 we get

$$\lambda = \frac{3.0 \times 10^8}{96 \times 10^6} = 3.1 \text{ m}$$

Note: Always use the following units :
Frequency=Hz
Wavelength=m
if Speed of waves is inm/s

wavelength = 3.1m ..... [3]

[Total: 10]

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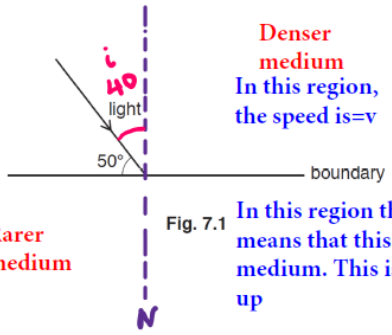
7 Fig. 7.1 shows light approaching a boundary between two materials at speed *v*. The speed of the light after crossing the boundary is 1.3*v*.



Denser medium
In this region, the speed is=v

Rarer medium

Fig. 7.1

In this region the speed is 1.3v. This as means that this resgion here rarer medium. This is bevcause the light speeds up

(a) Determine the angle of incidence.

40^0

angle of incidence = ... [1]

(b) Calculate the angle of refraction.

Given : Refractive index=n = 1.3

n= sini/sinr
we will use the equation :n= sinr/sini as light is travelling from gthe denser to the rarer medium
=sin 40 / sinr
1.3= sinr /sin 40

Note:Remember to use the formula ; n= sinr/sinr whenever light travels from denser to rarer medium

sin r = sin 40° x 1.3)
r =$\sin^{-1}$(sin 40° x 1.3)
= 57°

57^0

angle of refraction = ... [3]

[Total: 4]

8 Fig. 8.1 shows a 240 V mains supply connected to an air-conditioning unit and a freezer. A fuse X is placed in the circuit as shown.

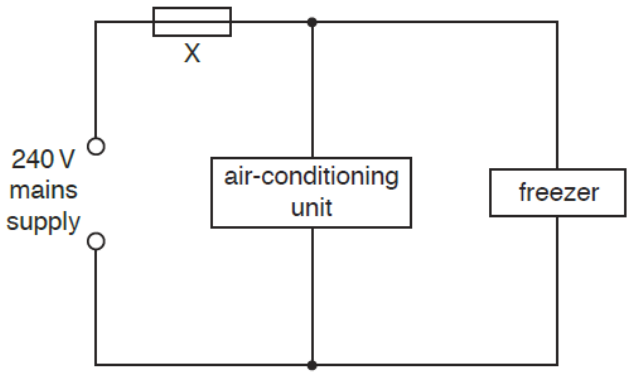


Fig. 8.1

The freezer has an operating power of 700 W.

(a) Calculate the current in the freezer.

P = VI

I = P/V
Hence:
I= 700/240= 2.9A

current = 2.9A [2]

(b) The maximum operating current of the air-conditioning unit is 7.5 A.

Fuses of current rating 1 A, 3 A, 5 A, 10 A, 13 A and 30 A are available.

Suggest a suitable rating for fuse X. Give **two** reasons for your answer.

fuse rating 13A fuse

Reason 1 If the rating is too low, then the fuse will melt even when the appliance is working normally

Reason 2 If the rating was too high, then the fuse wouldnt break and would only blow when the current was too high which would be dangerous to the aparatus as well as the people's lives

[3]

(c) A fuse is made out of a short length of wire.
Explain why fuses of a higher rating are made of thicker wire.

Resistance is inversely proportional to the area and so the resistance of the thicker wire is low. So the fuse will melt at a higher current because the heating effect is I^2R. Thus there will be less heating effect for the same current. [3]

(d) Electrical energy can be obtained from renewable and non-renewable sources of energy.

(i) State **two** renewable sources of energy.

[or] water/hydroelectric/ waves/tidal/geothermal

Source 1 Solar

Source 2 Wind [2]

(ii) State **one** social, economic or environmental disadvantage of one of your answers to **(d)(i)**.

Solar/wind energy: This energy is not always available. [1]

[Total: 11]

9 **(a)** Fig. 9.1 shows an electrical component.

Fig. 9.1

State the name of the component shown in Fig. 9.1. Light dependent resistor [1]

(b) In the space below, write down the truth table for a NOR gate.

Input 1	Input 2	Output
0	0	1
0	1	0
1	0	0
1	1	0

[2]

(c) Fig. 9.2 shows the connections between two logic gates.

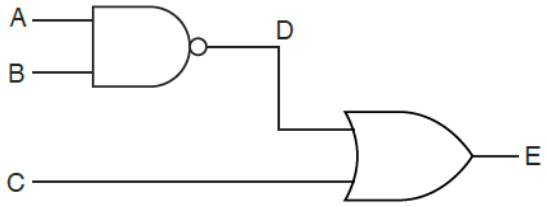


Fig. 9.2

Complete the truth table shown in Table 9.1 for this combination of logic gates.

Table 9.1

inputs			intermediate point	output
A	B	C	D	E
0	1	1	1	1
1	0	1	1	1
1	1	0	0	0
1	1	1	0	1

[3]

(d) Referring to a simple electron model, state what distinguishes electrical conductors from electrical insulators.

Electrical conductors have free electrons while electrical insulators do not have free electrons

.....

.....

..... [1]

[Total: 7]

10 Fig. 10.1 shows a simple alternating current generator.

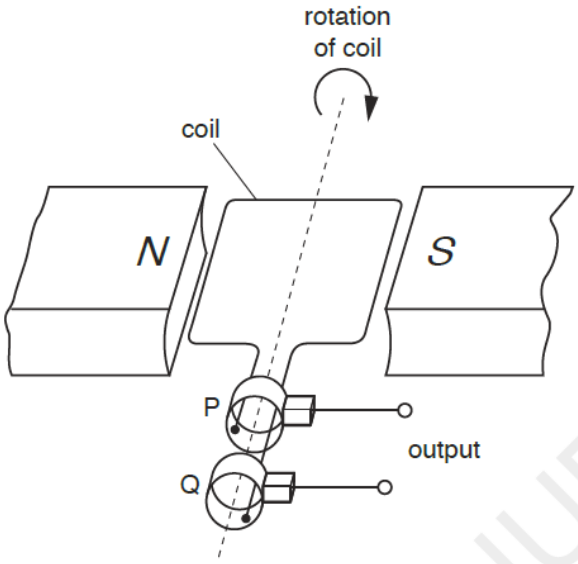
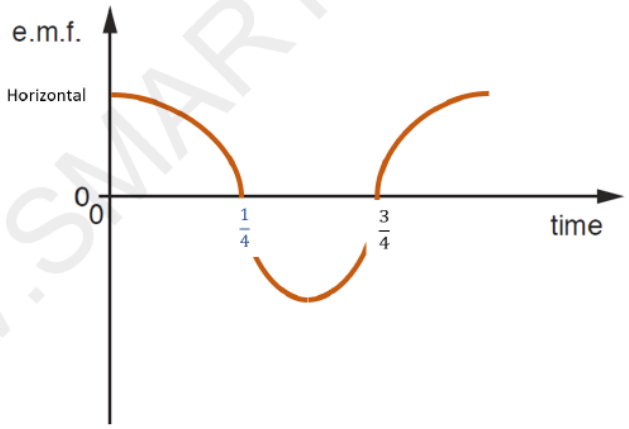


Fig. 10.1

(a) On Fig. 10.2, sketch a graph to show how the electromotive force (e.m.f.) induced varies with time for one revolution of the coil. Assume that the coil starts in the horizontal position, as shown in Fig. 10.1.
Label the points on the time axis where the coil has completed 1/4 revolution and 3/4 revolution. [3]



(b) Explain why an e.m.f. is induced only when the coil is turning.

An induced emf is only caused when the coil cuts the magnetic field and hence an

emf is only induced when the coil is turning

..... [1]

(c) State the name of the components labelled P and Q and state their purpose.

Name: Slip ring

Purpose: They provide a continuous connection when the coil is rotating

..... [2]

(d) State **two** possible changes that cause a larger e.m.f. to be induced.

1. Increase the strength of the magnetic field

2. Increase the speed of rotation of the coil

[2]

[or] Increase the number of turns of the coil.

[Total: 8]

11 **(a)** Americium (Am) is a radioactive isotope. A nucleus of americium contains 95 protons and 146 neutrons. It decays by emitting an α-particle to form a nucleus of an isotope of neptunium (Np).

Write down the nuclide equation for the decay of americium to neptunium.

$$^{241}_{95}Am \rightarrow {}^{4}_{2}\alpha + {}^{237}_{93}Np$$

[4]

(b) Ionisation smoke detectors contain americium and two small electrodes with a small voltage between them. The air between the electrodes is ionised by α-particles so that there is a small electric current between the electrodes.

(i) Suggest and explain the effect of smoke on the current between the electrodes in the smoke detector.

Suggestion: Current decreases

.....

Explanation: This is because the alpha particles are absorbed by the smoke.

..... [1]

(ii) Suggest **two** reasons for using an α-particle emitter in a smoke detector.

Reason 1 The alpha particles are more ionising than the beta particles

.....

Reason 2 Alpha particles ahve a short range in the air

..... [2]

[or] It is safer to use alpha particles as they do not travel out of smoke detectors

[Total: 7]