A-Level Physics

Paper 2

Unsolved Topical

Past Papers with Marking Schemes

All Variants

2014-2021

Title A-LEVEL UNSOLVED TOPICAL PHYSICS PAPER 2

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Legal Advisor Ashir Najeeb Khan (Advocate)
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For Complaints/Order **MS Books**
83-B Ghalib Market, Gulberg III Lahore
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PREFACE

Excellence in learning cannot be claimed without application of concepts in a dexterous way. In this regard one of the logical approach is to start in chunks; like chapter wise learning and applying the concept on exam based questions.

This booklet provides an opportunity to candidates to practice topic wise questions from previous years to the latest. Extensive working of Team MS Books has tried to take this booklet to perfection by collaborating with top of the line teachers.

We have added answer key / marks scheme at the end of each topic for the candidate to compare the hfis/her answer to the best.

MS Books strives to maintain actual spacing between consecutive questions and within options as per CAIE format which gives students a more realistic feel of attempting question.

Review, feedback and contribution in this booklet by various competent teachers of a subject belonging to renowned school chains make it most valuable resource and tool for both teachers and students.
With all belief in strength of this resource material I can confidently claim that it is worth in achieving brilliance.

Our sincere thanks and gratification to Mr. Syed Jabran Ali Kamran who took out special time to help compile and manage this booklet. We would also like to appreciate physics faculty for reviewing and indorsing it.

REVIEWED & RECOMMENDED BY

Syed Jabran Ali Kamran
LGS (Phase 5 & paragon),
LACAS (Gulberg, Barki, JT)
0336-4864345

Muhammad Javed Sulehri
BDC, LGS (Paragon & Gulberg),
ROOTS IVY, The City School (ALGC)
0333-4224165

Mirza Irshad Baig
SICAS, Bloomfield Hall, LACAS, MGS
0333-4205837

Nausher Shahzad Alam
Yale, Durham, GIKI, University of London
LGS Defence, BCCG, The City School
0322-8470000

Aamir Mustafa
LACAS, LGS (Gulberg & JT), BSS
0321-4621091

Abdul Hakeem
LGS, BSS, ALMA
0300-4810136

Muhammad Arshad Chaudhry
Ex-Aithison, LGS (JT & 1A1), LACAS BSS ALJT,
Pak Turk
0300-9412902

CONTENT TABLE

Physical Quantities and Units

Q1/P22/M/J/14

1 **(a)** Show that the SI base units of power are $kg\,m^2\,s^{-3}$.

[3]

(b) The rate of flow of thermal energy $\frac{Q}{t}$ in a material is given by

$$\frac{Q}{t} = \frac{CAT}{x}$$

where A is the cross-sectional area of the material,
T is the temperature difference across the thickness of the material,
x is the thickness of the material,
C is a constant.

Determine the SI base units of C.

base units ..... [4]

Q1/P23/M/J/14

2 **(a)** Underline **all** the base quantities in the following list.

ampere charge current mass second temperature weight [2]

(b) The potential energy E_P stored in a stretched wire is given by

$$E_P = \tfrac{1}{2} C \sigma^2 V$$

where C is a constant,
σ is the strain,
V is the volume of the wire.

Determine the SI base units of C.

base units .....[3]

Q1/P21/O/N/14

3 **(a)** Mass, length and time are SI base quantities.
State two other base quantities.

1. .....

2. .....

[2]

(b) A mass m is placed on the end of a spring that is hanging vertically, as shown in Fig. 1.1.

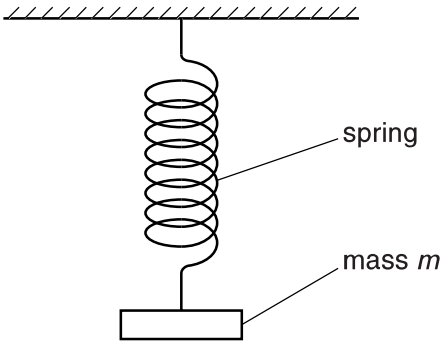

Fig. 1.1

The mass is made to oscillate vertically. The time period of the oscillations of the mass is T.
The period T is given by

$$T = C\sqrt{\frac{m}{k}}$$

where C is a constant and k is the spring constant.
Show that C has no units.

[3]

Q1/P22/M/J/15

4 **(a)** Use the definition of work done to show that the SI base units of energy are $kg\,m^2\,s^{-2}$.

[2]

(b) Define potential difference.

.....

..... [1]

(c) Determine the SI base units of resistance. Show your working.

units ..... [3]

Q1/P23/M/J/15

5 **(a)** The distance between the Sun and the Earth is 1.5×10^{11} m. State this distance in Gm.

distance = ... Gm [1]

(b) The distance from the centre of the Earth to a satellite above the equator is 42.3 Mm. The radius of the Earth is 6380 km.
A microwave signal is sent from a point on the Earth directly below the satellite.
Calculate the time taken for the microwave signal to travel to the satellite and back.

time = ... s [2]

(c) The speed v of a sound wave through a gas of density ρ and pressure P is given by

$$v = \sqrt{\frac{CP}{\rho}}$$

where C is a constant.
Show that C has no unit.

[3]

(d) Underline all the scalar quantities in the list below.

acceleration energy momentum power weight [1]

(e) A boat travels across a river in which the water is moving at a speed of $1.8\,m\,s^{-1}$.
The velocity vectors for the boat and the river water are shown to scale in Fig. 1.1.

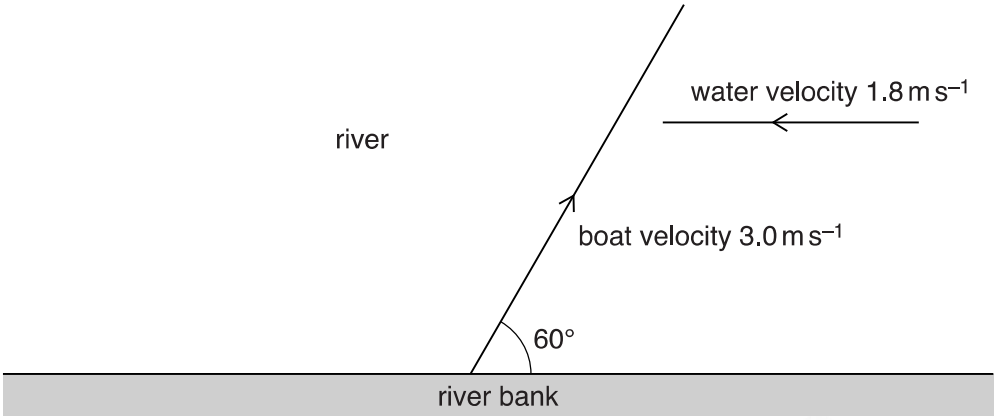

Fig. 1.1 (shown to scale)

In still water the speed of the boat is $3.0\,m\,s^{-1}$. The boat is directed at an angle of 60° to the river bank.

(i) On Fig. 1.1, draw a vector triangle or a scale diagram to show the resultant velocity of the boat. [2]

(ii) Determine the magnitude of the resultant velocity of the boat.

resultant velocity = ... $m\,s^{-1}$ [2]

Q1/P22/M/J/14

1 **(a)** power = energy / time *or* work done / time B1
force: kg m s^{-2} (including from *mg* in *mgh* or *Fv*)
or kinetic energy ($\frac{1}{2}$ mv^2): kg (m s^{-1})^2 B1
(distance: m and (time)$^{-1}$: s^{-1}) and hence power: kg m s^{-2} m s^{-1} = kg m^2 s^{-3} B1 [3]

(b) Q/t : kg m^2 s^{-3} C1
A: m^2 and x m and T: K C1
correct substitution into $C = (Qx) / tAT$ or equivalent, or with cancellation C1
units of C : kg m s^{-3} K^{-1} A1 [4]

Q1/P23/M/J/14

2 **(a)** current, mass and temperature
two correct 2/2, one omission or error 1/2 A2 [2]

(b) σ no units, V: m^3 C1
E_P: kg m^2 s^{-2} C1
C: kg m^2 s^{-2} × m^{-3} = kg m^{-1} s^{-2} A1 [3]

Q1/P21/O/N/14

3 **(a)** temperature B1
current B1 [2]
(allow amount of substance and luminous intensity)

(b) base units of force constant: kg m s^{-2} m^{-1} or kg s^{-2} B1
base units of time and mass: s and kg C1
base units of C: s(kg s^{-2} / kg)$^{1/2}$ cancelling to show no units B1 [3]

Q1/P22/M/J/15

4 **(a)** (work =) force × distance or force × displacement or (W =) $F \times d$ M1
units of work: kg m s^{-2} × m = kg m^2 s^{-2} A1 [2]

(b) (p.d. =) $\frac{\text{work (done) or energy (transformed) (from electrical to other forms)}}{\text{charge}}$ B1 [1]

(c) $R = V/I$ B1
units of V: kg m^2 s^{-2} / A s **and** units of I: A C1
or
$R = P/I^2$ [or $P = VI$ **and** $V = IR$] (B1)
units of P: kg m^2 s^{-3} **and** units of I: A (C1)
or
$R = V^2/P$ (B1)
units of V: kg m^2 s^{-2} / A s **and** units of P: kg m^2 s^{-3} (C1)
units of R: (kg m^2 s^{-2} / A^2 s =) kg m^2 s^{-3} A^{-2} A1 [3]

Q1/P23/M/J/15

5 **(a)** 150 or 1.5×10^2 Gm A1 [1]

(b) distance = $2 \times (42.3 - 6.38) \times 10^6$ (= 7.184×10^7 m) C1

(time =) $7.184 \times 10^7 / (3.0 \times 10^8) = 0.24$ (0.239) s A1 [2]

(c) units of pressure P: $\text{kg m s}^{-2} / \text{m}^2 = \text{kg m}^{-1} \text{s}^{-2}$ M1

units of density ρ: kg m^{-3} and speed v: m s^{-1} M1

simplification for units of C: $C = v^2 \rho / P$ units: $(\text{m}^2 \text{s}^{-2} \text{kg m}^{-3}) / \text{kg m}^{-1} \text{s}^{-2}$ and cancelling to give no units for C A1 [3]

(d) energy and power *(both underlined and no others)* A1 [1]

(e) **(i)** vector triangle of correct orientation M1

three arrows for the velocities in the correct directions A1 [2]

(ii) length measured from scale diagram 5.2 ± 0.2 cm or components of boat speed determined parallel and perpendicular to river flow C1

velocity = 2.6 m s^{-1} (allow ± 0.1 m s^{-1}) A1 [2]

Q1/P23/O/N/15

6 **(a)** energy or W: $\text{kg m}^2 \text{s}^{-2}$
or
power or P: $\text{kg m}^2 \text{s}^{-3}$ M1

intensity or I: $\text{kg m}^2 \text{s}^{-2} \text{m}^{-2} \text{s}^{-1}$ (from use of energy expression)
or
$\text{kg m}^2 \text{s}^{-3} \text{m}^{-2}$ (from use of power expression)

indication of simplification to kg s^{-3} A1 [2]

(b) **(i)** ρ: kg m^{-3}, c: m s^{-1}, f: s^{-1}, x_0: m M1

substitution of terms in an appropriate equation and simplification to show K has no units A1 [2]

(ii) $I = 20 \times 1.2 \times 330 \times (260)^2 \times (0.24 \times 10^{-9})^2$ C1

$= 3.1 \times 10^{-11}$ (W m^{-2}) C1

= 31 (30.8) pW m^{-2} A1 [3]

Q1/P23/M/J/16

7 **(a)** scalars: energy, power and time A1

vectors: momentum and weight A1 [2]

(b) **(i)** triangle with right angles between 120 m and 80 m, arrows in correct direction and result displacement from start to finish arrow in correct direction and labelled R B1 [1]

(ii) **1.** average speed (= 200 / 27) = 7.4 m s^{-1} A1 [1]

2. resultant displacement (= $[120^2 + 80^2]^{1/2}$) = 144 (m) C1

average velocity (= 144 / 27) = 5.3(3) m s^{-1} A1

direction (= $\tan^{-1}$ 80 / 120) = 34° (33.7) A1 [3]