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Cambridge International General Certificate of Secondary Education

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**PHYSICS**

**0625/41**

Paper 4 Extended Theory

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MARK SCHEME

Maximum Mark: 80

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This document consists of **10** printed pages.

| Question  | Answer                                                                                           | Marks     |
|-----------|--------------------------------------------------------------------------------------------------|-----------|
| 1(a)(i)   | Distance = area under graph OR $0.5 \times 20 \times 13$                                         | <b>C1</b> |
|           | 130 m                                                                                            | <b>A1</b> |
| 1(a)(ii)  | $(a =) (v - u) / t$ OR $(a =) v / t$ OR $13 / 20$                                                | <b>C1</b> |
|           | $0.65 \text{ m / s}^2$                                                                           | <b>A1</b> |
| 1(a)(iii) | $(F =) ma$ OR $1200 \times 0.65$                                                                 | <b>C1</b> |
|           | = 780 N                                                                                          | <b>A1</b> |
| 1(b)      | Acceleration decreases OR rate of increase of speed decreases OR speed increases at a lower rate | <b>B1</b> |

| Question | Answer                                                                                                                            | Marks     |
|----------|-----------------------------------------------------------------------------------------------------------------------------------|-----------|
| 2(a)     | Extension of a spring is (directly) proportional to load / force / weight OR $F = ke$ where $e$ is extension                      | <b>B1</b> |
| 2(b)(i)  | <u>Straight</u> line drawn from origin to (64 mm, 120 N)                                                                          | <b>B1</b> |
| 2(b)(ii) | $F = ke$ in any form OR $120 / 64$ OR $120 / 6.4$ OR $120 / 0.064$                                                                | <b>C1</b> |
|          | c.a.o. $1.9 \text{ N / mm}$ OR $19 \text{ N / cm}$ OR $1900 \text{ N / m}$                                                        | <b>A1</b> |
| 2(c)     | Above 120 N / at 140 N, the spring does not obey Hooke's law<br>OR the extension is not proportional to the load / weight / force | <b>B1</b> |
|          | The elastic limit / limit of proportionality of the spring has been exceeded                                                      | <b>B1</b> |

| Question | Answer                                                                                                                                    | Marks     |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 3(a)     | (Measure of) quantity / amount of matter OR (property) that resists change in motion / speed / momentum<br>OR measure of a body's inertia | <b>B1</b> |
| 3(b)(i)  | $d = m / V$ OR in words OR $0.44 / 0.080^3$ OR $0.44 / 5.12 \times 10^{-4}$ OR $440 / 8^3$ OR $440 / 512$ OR $0.44 / 8^3$ OR $0.44 / 512$ | <b>C1</b> |
|          | $0.86 \text{ g / cm}^3$ OR $860 \text{ kg / m}^3$ OR $8.6 \times 10^{-4} \text{ kg / cm}^3$                                               | <b>A1</b> |
| 3(b)(ii) | Sinks OR does not float AND (cube) denser (than oil)                                                                                      | <b>B1</b> |
| 3(c)(i)  | $W = mg$ OR ( $g =$ ) $W / m$ OR $0.70 / 0.44$                                                                                            | <b>C1</b> |
|          | $1.6 \text{ N / kg}$                                                                                                                      | <b>A1</b> |
| 3(c)(ii) | ( $P =$ ) $hdg$ OR $0.030 \times 850 \times 1.6$                                                                                          | <b>C1</b> |
|          | $41 \text{ Pa}$                                                                                                                           | <b>A1</b> |

| Question | Answer                                                                                                                                                      | Marks     |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 4(a)     | Atoms collide with wall (and rebound) OR atoms rebound from wall                                                                                            | <b>B1</b> |
|          | (Atoms) undergo change of momentum                                                                                                                          | <b>C1</b> |
|          | Force on wall = (total) rate of change of momentum (of atoms)<br>OR = change of momentum (of atoms) per second<br>OR = change of momentum (of atoms) / time | <b>A1</b> |
| 4(b)(i)  | Fewer atoms per unit volume OR density of gas less                                                                                                          | <b>B1</b> |
|          | Rate of collision (with walls of balloon) decreases OR Fewer collisions per unit area                                                                       | <b>B1</b> |
| 4(b)(ii) | $PV = \text{constant}$ OR $P_1 V_1 = P_2 V_2$ OR ( $P_2 =$ ) $P_1 V_1 / V_2$ OR $1.0 \times 10^5 \times 9.6 / 12$                                           | <b>C1</b> |
|          | $8.0 \times 10^4 \text{ Pa}$                                                                                                                                | <b>A1</b> |

| Question | Answer                                                                             | Marks       |
|----------|------------------------------------------------------------------------------------|-------------|
| 5(a)     | Tick 2nd box only                                                                  | <b>B1</b>   |
| 5(b)(i)  | At least 3 parallel wavefronts in shallow water sloping upwards from left to right | <b>B1</b>   |
|          | Wavefronts in shallow water meet wavefronts in deep water                          | <b>B1</b>   |
| 5(b)(ii) | Indication that frequency is same in deep and shallow water                        | <b>C1</b>   |
|          | In deep water $v = f\lambda$ in any form OR $(f =) v / \lambda$ OR $80 / 1.4$      | <b>C1</b>   |
|          | $= 57.1$ (Hz)                                                                      | <b>C1</b>   |
|          | Wavelength in shallow water $= v / f$ OR $60 / 57.1 = 1.05$ cm                     | <b>A1</b>   |
|          | OR                                                                                 |             |
|          | speed in deep water / speed in shallow water $= 0.80 / 0.60$                       | <b>(C1)</b> |
|          | $= 1.33$                                                                           | <b>(C1)</b> |
|          | (f is constant so) $\lambda$ in deep water / $\lambda$ in shallow water $= 1.33$   | <b>(C1)</b> |
|          | $\lambda$ in shallow water $= 1.4 / 1.33 = 1.05$ cm                                | <b>(A1)</b> |

| Question | Answer                                                                              | Marks     |
|----------|-------------------------------------------------------------------------------------|-----------|
| 6(a)     | 1500 m / s    liquid<br>5000 m / s    solid<br>300 m / s    gas                     | <b>B2</b> |
| 6(b)(i)  | X and Y marked at centres of any two rarefactions                                   | <b>B1</b> |
| 6(b)(ii) | Area of low pressure or low density (of atoms) or where atoms / molecules far apart | <b>B1</b> |
| 6(c)     | $v = d/t$ or $2d/t$ in any form                                                     | <b>C1</b> |
|          | $d = vt/2$ OR $3.0 \times 10^8 \times 2.56 / 2$                                     | <b>C1</b> |
|          | $3.84 \times 10^8$ m OR $3.84 \times 10^5$ km                                       | <b>A1</b> |

| Question | Answer                                                                                                    | Marks     |
|----------|-----------------------------------------------------------------------------------------------------------|-----------|
| 7(a)     | One ray with correct path through lens                                                                    | <b>B1</b> |
|          | Another ray with correct path through lens<br>Rays intersect to right of F and below axis, inverted image | <b>B1</b> |
|          | drawn <u>and</u> labelled I                                                                               | <b>B1</b> |
| 7(b)     | enlarged, upright and virtual <u>only</u> underlined or ringed                                            | <b>B2</b> |
|          | Two of above descriptions underlined                                                                      | <b>B1</b> |
| 7(c)     | On entering prism: green ray deflection more than red ray and above normal                                | <b>B1</b> |
|          | On leaving prism: diverging downwards from red ray and not along surface of prism                         | <b>B1</b> |

| Question | Answer                                                                             | Marks     |
|----------|------------------------------------------------------------------------------------|-----------|
| 8        | Hydroelectric                                                                      |           |
| 8(a)     | Hydroelectric named OR water from behind dam                                       | <b>B1</b> |
|          | K.E. of (falling) water used / P.E. of stored water                                | <b>B1</b> |
|          | Turbine / waterwheel / paddle wheel operated                                       | <b>B1</b> |
|          | (Turbine) turns / drives a generator (that produces electricity)                   | <b>B1</b> |
| 8(b)     | Rain (fills lakes in high places)                                                  | <b>B1</b> |
|          | Cause of rain is the Sun, so renewable                                             | <b>B1</b> |
| 8(c)     | Sun evaporates water from sea etc. to fall (later) as rain                         | <b>B1</b> |
|          | Sun is the source of energy.                                                       | <b>B1</b> |
| 8        | Tidal flow                                                                         |           |
| 8(a)     | Tides / tidal flow named                                                           | <b>B1</b> |
|          | K.E. of water used                                                                 | <b>B1</b> |
|          | Turbine / waterwheel / paddle wheel operated                                       | <b>B1</b> |
|          | (Turbine) turns / drives a generator (that produces electricity)                   | <b>B1</b> |
| 8(b)     | Moon (and Sun) causes tides                                                        | <b>B1</b> |
|          | Moon (and Sun) permanently in place, so renewable                                  | <b>B1</b> |
| 8(c)     | Attraction due to Moon's (and Sun's) gravity causes tides                          | <b>B1</b> |
|          | Sun is a source of (part of) the energy OR Sun is not the primary source of energy | <b>B1</b> |

| Question | Answer                                                              | Marks     |
|----------|---------------------------------------------------------------------|-----------|
| 8 Waves  |                                                                     |           |
| 8(a)     | Waves on surface of sea                                             | <b>B1</b> |
|          | K.E. of water used to oscillate a floating mechanism                | <b>B1</b> |
|          | Turbine / waterwheel / paddle wheel operated                        | <b>B1</b> |
|          | (Turbine) turns / drives a generator (that produces electricity)    | <b>B1</b> |
| 8(b)     | Wind causes waves                                                   | <b>B1</b> |
|          | Sun causes wind, so renewable                                       | <b>B1</b> |
| 8(c)     | Winds are air currents caused by thermal energy / heat from the Sun | <b>B1</b> |
|          | Sun is the source of energy                                         | <b>B1</b> |

| Question  | Answer                                                                            | Marks       |
|-----------|-----------------------------------------------------------------------------------|-------------|
| 9(a)(i)   | $(3 \times 1.5 =) 4.5 \text{ V}$                                                  | <b>B1</b>   |
| 9(a)(ii)  | $1/R = 1/R_1 + 1/R_2$ OR $R = 1/(1/R_1 + 1/R_2)$ OR $(R =) R_1 R_2 / (R_1 + R_2)$ | <b>C1</b>   |
|           | Correct substitution of 3 and 6                                                   | <b>C1</b>   |
|           | $(R =) 2.0 \Omega$                                                                | <b>A1</b>   |
| 9(a)(iii) | $V = IR$ in any form OR $(I =) V/R$ OR $4.5/3$                                    | <b>C1</b>   |
|           | 1.5 A                                                                             | <b>A1</b>   |
|           | OR                                                                                |             |
|           | $I_{\text{total}} = 4.5/2 = 2.25 \text{ A}$                                       | <b>(C1)</b> |
|           | For $3 \Omega$ , $I = 2.25 \times 6/9 = 1.5 \text{ A}$                            | <b>(A1)</b> |
| 9(b)(i)   | Connect ammeter (in wire) from A to B OR from H to G                              | <b>B1</b>   |
| 9(b)(ii)  | Connect voltmeter (terminals) to A and H OR B and G OR C and D OR E and F         | <b>B1</b>   |

| Question  | Answer                                                                                                                                               | Marks     |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 10(a)(i)  |                                                                     | <b>B1</b> |
| 10(a)(ii) | To allow flow (of current) in one direction                                                                                                          | <b>B1</b> |
| 10(b)(i)  | Wire from B to + or – terminal of battery and wire from A to other terminal of battery                                                               | <b>B1</b> |
|           | Diode to allow current in at + terminal or out at – terminal                                                                                         | <b>B1</b> |
| 10(b)(ii) | Alternating current in coil Y sets up alternating magnetic field OR causes change in magnetic flux                                                   | <b>B1</b> |
|           | Alternating field / change in flux cuts coil X OR Alternating field links with coil X                                                                | <b>B1</b> |
|           | (Alternating) voltage / current is <u>induced</u> in coil X<br>OR (Alternating) voltage / current is produced in coil X by electromagnetic induction | <b>B1</b> |

| Question  | Answer                                                                                                                                                                          | Marks     |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 11(a)(i)  | An electron                                                                                                                                                                     | <b>M1</b> |
|           | In / from / by the nucleus                                                                                                                                                      | <b>A1</b> |
| 11(a)(ii) | Proton numbers balance on left and right sides of equation                                                                                                                      | <b>B1</b> |
|           | Nucleons numbers balance on left and right sides of equation                                                                                                                    | <b>B1</b> |
|           | ${}^0_{-1}\beta$                                                                                                                                                                | <b>B1</b> |
| 11(b)     | Time for activity / count rate / number of nuclei / number of atoms to halve                                                                                                    | <b>B1</b> |
| 11(c)(i)  | $\alpha$ -particles would be stopped / absorbed by <u>the plastic</u> / <u>bottle</u>                                                                                           | <b>B1</b> |
| 11(c)(ii) | $\gamma$ -rays would not be absorbed by the liquid / bottle OR reading not reduced (in passing through liquid / bottle)<br>OR very penetrative so no change in detector reading | <b>B1</b> |