

**MARK SCHEME for the October/November 2010 question paper
for the guidance of teachers**

5054 PHYSICS

5054/21

Paper 2 (Theory), maximum raw mark 75

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

- CIE will not enter into discussions or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the October/November 2010 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.



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Section A

| | | | | |
|---|---------|---|----------------|-----|
| 1 | (a) (i) | any one time between 1.60 and 2.50 s or range of correct values | B1 | [1] |
| | (ii) | any one time between 0.75 and 1.65 s or range of correct values | B1 | [1] |
| | (iii) | 2.5(0) s | B1 | [1] |
| | (b) | area (under graph) or $\frac{1}{2}bh$ or $\frac{1}{2}gt^2$ or $\frac{1}{2} \times 0.75 \times (7.3 \text{ to } 7.5)$ 2.7(375) to 2.8(125) m | C1 A1 | [2] |
| 2 | (a) | gravitational/centripetal (pull/attraction) of the Sun | B1 B1 | [2] |
| | (b) (i) | arrow touching Venus towards centre/left (must pass through Sun if extended) | B1 | [1] |
| | (ii) | ($F =$) ma or $4.9 \times 10^{24} \times 9.7 \times 10^{-3}$ $4.8(4.753) \times 10^{22}$ N | C1 A1 | [2] |
| | (c) | direction of movement \neq direction of force force/it is perpendicular/at right angles to distance moved or does not move any distance in direction of force | C1 A1 | [2] |
| 3 | (a) | energy cannot be created/destroyed (nb. only one required) energy cannot be destroyed or created (i.e. the other one as well) or (merely) transformed or total energy in an isolated system is constant | B1 B1 | [2] |
| | (b) (i) | chemical (potential) at beginning to electrical (and heat) at end | B1 B1 | [2] |
| | (ii) | light heat/thermal/internal | B1 B1 | [2] |
| | (c) | less heat; same light or less chemical/electrical; less heat or less chemical/electrical; same light | B2 B2 B2 | [2] |
| 4 | (a) (i) | e/m waves can travel/satellite in a vacuum/space | B1 | [1] |
| | (ii) | microwave/radio wave (region) | B1 | [1] |
| | (iii) | greater coverage/less ground-based infrastructure/less obstruction | B1 | [1] |
| | (b) | ($x =$) vt or $3.0 \times 10^8 \times 0.24$ 7.2×10^7 m or 72 000 km | C1 A1 | [2] |

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- 5 (a) (i) ($P = VI$ or 12×35
420 W or J/s) C1 A1 [2]
- (ii) ($Q = Pt$ or VIt or $12 \times 35 \times 2$ or $420/ecf$ (i) $\times 2$
 $12 \times 35 \times 120$ or $420/ecf$ (i) $\times 120$
 $5.0(4) \times 10^4$ J) C1 C1 A1 [3]
- (b) (i) ($m = Q/I_f$ or $5.04 \times 10^4/330$
 $150/153/152.7272$) g or 152 g from 5.0×10^4 J) C1 A1 [2]
- (ii) heat lost to **glass/air/wires/water/surroundings**
(i.e. specified heat loss)
ice below 0°C B1 B1 [2]
- 6 (a) (i) current in magnetic field or motor effect/LH rule or coil is magnet
(produces) force or current **direction** changes or coil moves or
repulsion **and** attraction B1 B1 B1 [3]
force changes direction/backwards and forwards
- (ii) air (atoms/molecules/particles) (next to cone) vibrates B1
compressions **and** rarefactions or high **and** low pressure
or vibrations passed on or longitudinal B1 [2]
- (b) the note is louder/has greater intensity (**not** changed frequency) B1 [1]
- 7 (a) (i) p.d. rises B1
the capacitor charges/at a decreasing rate/to a maximum value B1 [2]
- (ii) it takes a certain time/200 s to reach certain charge/p.d.
or certain charge/p.d. activates alarm B1 [1]
- (b) ($I = Q/t$ or $5.4 \times 10^{-7}/200$
 $2.7(0) \times 10^{-9}$ A) C1 A1 [2]

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Section B

- 8 (a) (i) ($W =$) mg or 70×10 or $70 \times 9.8(1)$ etc. C1
700(.0) N A1 [2]
- (ii) ($P =$) F/A or $700/35$ C1
 $700/(35 \times 4)$ or $700/0.0035$ or $700/(0.0035 \times 4)$ C1
50 000 Pa or 50.0 kPa or 5.0 N/cm^2 A1 [3]
- (b) (i) molecules/atoms/particles move or collide B1
molecules/atoms/particles collide with cylinder/walls M1
exert force on walls (as they collide) A1
spread out effect (of forces) is pressure or (force)/ m^2 or similar B1 [4]
- (ii) molecules/atoms/particles closer/denser/more in given volume C1
more collisions per (unit) area/ m^2 or per (unit) time/s (not faster) A1 [2]
- (c) (i) speed (of molecules/atoms/particles) increases/k.e. increases B1 [1]
- (ii) car (body) higher (off the ground) B1
collisions more violent or gas in cylinder expanded B1
fewer collisions of molecules/atoms/particles needed or pressure rises initially B1 [3]
- 9 (a) (i) horizontal ray from Q to pool edge and on to P from corner B1
critical angle marked C or obvious B1 [2]
- (ii) for $i = 90^\circ$ or horizontal ray B1
angle(in water) equals/cannot be less than critical/C B1 [2]
- (iii) ($n =$) $\sin i/\sin r$ or $1/\sin C$ or $1/n = \sin C$ or $\sin 90^\circ/\sin 49^\circ$ B1
or $1/\sin 49^\circ$ B1 [2]
1.3(2501)
- (iv) decreases B1 [1]
- (b) (i) any two of:
real
less bright
further from lens
beyond $2f$ B2 [2]
- (ii) straight ray from R to top of image B1 [1]
- (iii) where ray crosses principal axis, vertical line (L or drawn lens) B1 [1]
- (iv) paraxial ray from R to lens refracted to top of image
or paraxial ray from lens to top of image, traced back to R M1
F marked A1 [2]
- (v) 1.6 – 1.9 cm or attempt to use $1/u + 1/v$ C1
19 – 23 cm (2 sig. fig. only) A1 [2]

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| | | | | |
|------------|--|----------------------------------|----|--------|
| 10 (a) (i) | 15 | | B1 | [1] |
| | (ii) | 32 | | B1 [1] |
| (b) (i) | $^{32}_{15}\text{P} (\rightarrow)$ | | B1 | |
| | superscripts: 32 on S and 0 on beta (allow e) | | B1 | |
| | subscripts: 16 on S and -1 on beta (allow e) | (just $^{32}_{16}\text{S} 1/2$) | B1 | [3] |
| (ii) | electron | | M1 | |
| | high speed or from nucleus or causes ionisation | | A1 | [2] |
| (iii) | record/measure background reading/count/radiation | | B1 | |
| | sample near named detector | | B1 | |
| | interpose paper/card/less than 5 cm air and no change in reading | | B1 | |
| | interpose 2 mm – 20 mm of aluminium and reading = background | | | |
| | n.b. points may be made on a diagram, other methods marked analogously | | B1 | [4] |
| (c) (i) | time for some measurable quantity to halve | | M1 | |
| | number of atoms/no. of nuclei/activity/count rate | | A1 | [2] |
| (ii) | 350÷1400 or ¼ or 2 (half-lives) | | C1 | |
| | 28.6 days | | A1 | [2] |

MARKING SCHEME CODE:

B1 Independent Mark

C1 Compensation Mark:

awarded automatically if the answer is correct. i.e. the working need not be seen if the answer is correct; also given if the answer is wrong but the point is seen in the working.

M1 (Compulsory) Method Mark:

if not awarded subsequent A marks are lost (up to next B, M or C mark).

A1 Answer Mark.

c.a.o. correct answer only (including unit)

e.e.o.o. each error or omission

e.c.f. error carried forward:

it is usually awarded even where not specifically indicated.

i.e. subsequent working including a previous error is credited, if otherwise correct.

Incorrect units, errors in powers of 10 (except where the power of 10 comes from $g = 10 \text{ N/kg}$) and unit multipliers are to be treated as arithmetical errors.

Correct numerical answers with incorrect units will normally gain preceding C marks even when the working is not shown.

Do not penalise a sig. fig. fraction or a unit error more than once in the same question.

Sig. Fig. Answers must given to 2 or more sig. fig. except where the answer is exactly 0.6, 2 etc.

Answers given to 2 or 3 sig. fig. must be correctly rounded – but a 5 can produce a rounding up or down.