General Certificate of Secondary Education
2016

GCSE Physics

Unit 2

Higher Tier

[GPH22]

FRIDAY 24 JUNE, MORNING

MARK SCHEME

General Marking Instructions and Mark Grids

Introduction
Mark schemes are intended to ensure that the GCSE examination is marked consistently and fairly. The mark schemes provide markers with an indication of the nature and range of candidates' responses likely to be worthy of credit. They also set out the criteria that they should apply in allocating marks to candidates' responses. The mark schemes should be read in conjunction with these marking instructions.

Quality of candidates' responses
In marking the examination papers, examiners should be looking for a quality response reflecting the level of maturity which may reasonably be expected of a 16-year-old which is the age at which the majority of candidates sit their GCSE examinations.

Flexibility in marking
Mark schemes are not intended to be totally prescriptive. No mark scheme can cover all the responses which candidates may produce. In the event of unanticipated answers, examiners are expected to use their professional judgement to assess the validity of answers. If an answer is particularly problematic, the examiners should seek the guidance of the Supervising Examiner.

Positive marking
Examiners must be positive in their marking, giving appropriate credit for description, explanation and analysis, using knowledge and understanding and for the appropriate use of evidence and reasoned argument to express and evaluate personal responses, informed insights and differing viewpoints. Examiners should make use of the whole of the available mark range of any particular question and be prepared to award full marks for a response which is as good as might reasonably be expected of a 16-year-old GCSE candidate.

Awarding zero marks
Marks should only be awarded for valid responses and no marks should be awarded for an answer which is completely incorrect or inappropriate.

Types of mark scheme
Mark Schemes for questions which require candidates to respond in extended written form are marked on the basis of levels of response which take account of the quality of written communication.

Other questions which require only short answers are marked on a point for point basis with marks awarded for each valid piece of information provided.

1 **(a)** **(i)** Transverse   [1]

(ii) 0.002 vibrations/waves (pass) (a fixed point) ⎫ independent   [1]
every second   ⎭ marking   [1]   [2]

(iii) $v = f\lambda$ (must be an equation), e.g. $f\lambda$ unqualified give [0]   [1]
     $= (0.002) \times (2\,500 \times 1000)$ [1] per bracketed item   [2]
     $= 5\,000$ (m/s)   [1]   [4]
     (If 10^n error [–1] once only)

(b) **(i)** echo   [1]

(ii) $3 \times 40 = 120$ microseconds   sight of 3 divisions [1]   [2]

(iii) 60 (microseconds)   ecf from **(ii)**   [1]

(iv) distance = speed × time   [1]
     $= 1500 \times 0.00006$ ecf for time from **(iii)**   [2]
     $= 0.09$ (m)   [1]
     $= 9$ (cm)   [1]   [5]
(If 10^n error [–1] once only)

(v) X-rays kill/damage (cells) or are harmful to baby/cause cancer/
change in DNA/dangerous
or
ultrasound does not kill cells or harm the baby/less harmful/safe   [1]
'It' implies ultrasound

(c) microwaves   [1]
visible   [1]
X-rays   [1]   [3]   20

2 **(a)** **(i)** Refraction [1]

    (ii) Normal drawn (and marked N) on both sides, air and glass. [1]
          Ok if dotted.

    (iii) Angles of incidence and refraction both marked [1]

    (iv) Light slows down [2]
          Change of speed give [1]   Light speeds up give [0]

  (b) **(i)** Distance from the lens or optical centre to principal focus or focal
          point or where parallel rays incident to lens meet after refraction [1]

    (ii) **Indicative content:**
          Lens (in a holder)
          Screen/white sheet/wall/paper
          Metre rule/ruler/tape measure
          Choice of distant object, e.g. a tree, window or object $\geqslant 5\,$m away
          Move lens or screen until sharp image formed (focused or clear
          means sharp)
          Measure distance from lens to screen
          Repeat and average [both required]

Response	Mark
Candidates describe in detail using good SPG **at least 5 points** shown opposite. The form and style are of a high standard and specialist terms are used appropriately at all times.	[5]–[6]
Candidates describe in detail using good SPG **at least 3 points** shown opposite. The form and style are of a high standard and specialist terms are used appropriately on some occasions.	[3]–[4]
Candidates make some reference to **one of the points** shown opposite using good SPG. The form and style are of a satisfactory standard but there is limited use of specialist terms.	[1]–[2]
Response not worthy of credit	[0]

[6]

(c) **(i)** Two rays [any 2 of the 3 possible rays]   [2]
        Top of image marked   [1]   [3]
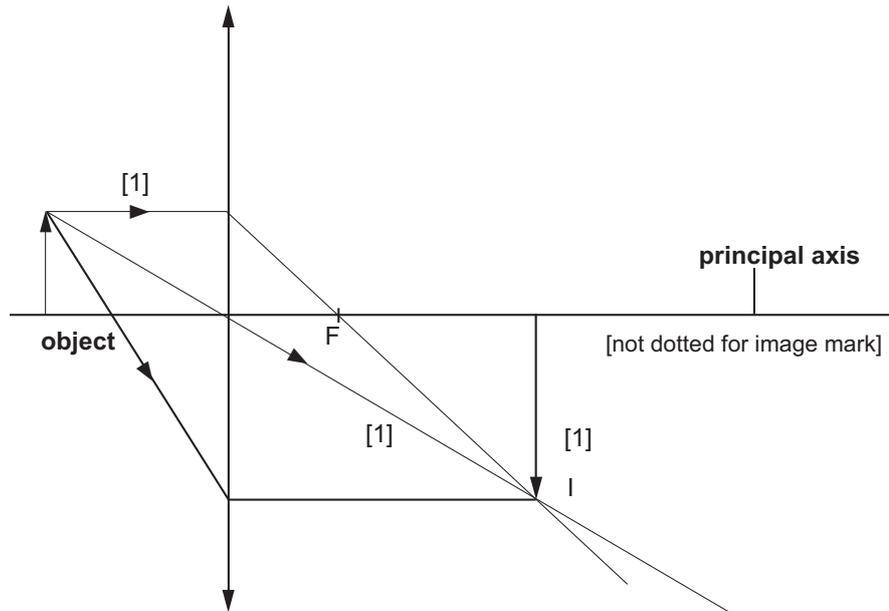
(ii) arrows on both rays
   conflicting arrows or wrong direction give [0]   [1]

(iii) Magnification 1.4 to 1.8
      1.3 or 1.9 give [1]   **No ecf from ray diagram**   [2]

(iv) Real/yes [1]
     Light passes through it/can be projected on a screen [1] } independent marking

     formed by real rays
     Opposite side from object give [0]   [2]   20

3 **(a)** **(i)** Suitable choice of scale on resistance axis [1]
At least half of the grid used.
Points correctly plotted ± 1 sq [$\frac{1}{2}$] each round UP to a
max of [2] [2]
Any (best) line fit through origin ± 1 sq and through one
other point [1] [4]
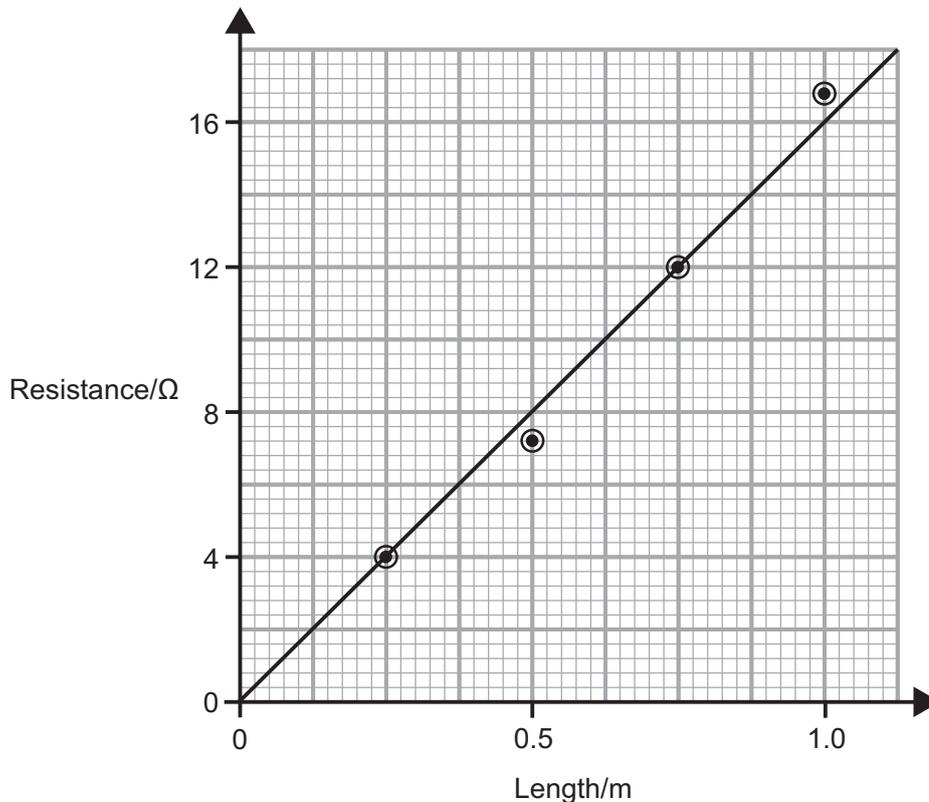
(ii) Find the gradient/put values into equation/k = R/L/divide R by L [1]

(iii) Gradient = rise/run = 16 ±1 consistent with
their line } independent [1]
Unit = Ω/m or $\frac{\Omega}{m}$ } marking [1] [2]

(b) **(i)** I = P/V **or** 720/240 = 3 (A) (sight of 3(A) give [2]) [2]
[1]   [1]

R = V/I **or** 240/3 = 80 (Ω) [2] [4]
[1]   [1]
or
P = V^2/R   720 = 240^2/R = 57 600/R
[1]   [1] for subs   [1]

R = 80 (Ω) [1]

(ii) length = 80/40   ecf from **(b)(i)** for R [1]
= 2 (m) [1] [2]

(iii) Resistance is **halved** or half the value of **(b)(i)**   ecf from **(b)(i)** [1]

(iv) Length must be **doubled** or twice the value in **(b)(ii) –** ecf [1]

(c) (i) 4.8 V [1]

    (ii) Cells/battery/power or voltage supply has not changed/parallel circuit. If **(c)(i)** is wrong or missing **(c)(ii)** gets [0] [1]

    (iii) = 0.8 (A)   No ecf from **(c)(i)** [1]

    (iv) Any 2 from 3:
        (In a circle we have) 2 (× 12Ω) resistors in parallel [1]
        so total resistance is now 6Ω or $\frac{1}{4}$ of original or decreases
        so the current is larger (is now 4 times) (the original value) [1] [2]

AVAILABLE MARKS

20

4 (a) Indicative content:
    The flow of oil causes the wheel to rotate
    As magnet passes coil a voltage/current is induced
    This is electromagnetic induction
   The greater the flow the faster the wheel rotates
   This produces more pulses (every second)
    The number of pulses in one second can be used to work out the volume per second

Response	Mark
Candidates describe in detail using good SPG **at least 5 points** shown opposite. The form and style are of a high standard and specialist terms are used appropriately at all times.	[5]–[6]
Candidates describe in detail using good SPG **at least 3 points** shown opposite. The form and style are of a high standard and specialist terms are used appropriately on some occasions.	[3]–[4]
Candidates make some reference to **one of the points** shown opposite using good SPG. The form and style are of a satisfactory standard but there is limited use of specialist terms.	[1]–[2]
Response not worthy of credit	[0]

[6]

(b) (i) {Ns/Np} = $\frac{120}{15}$ = 8 $\frac{Vs}{Vp}$ with no further working give [1]. [3]
        [1]   [1] Must be 8 on the answer line $\frac{1}{8}$ give [0]

    (ii) a.c. [1]

    (iii) The voltage (at the power station) is stepped up/increased [1]
         This reduces the current (in the transmission cables) [1]
         This reduces the energy/power lost (as heat) (in the cables) [1] [3]

    (iv) To step the voltage down [1]
         To 220 or 230 or 240 V or safe voltage or voltage suitable for appliances [1] [2]

(c) (i)
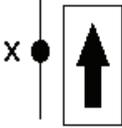
Can be outside box, near X

[1]

(ii)
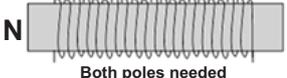
N ... S (may be inside circles at ends) **No ecf**

Both poles needed

[1]

(iii)

soft iron core
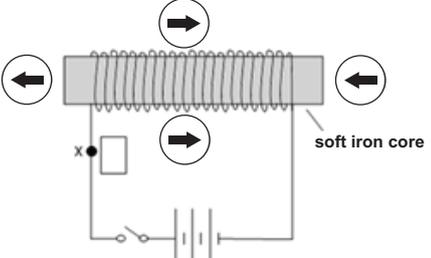
No ecf

Any 2 correct arrows will get [2]
(mark each arrow separately to a max of [2])

[2]

(iv) To make the current flow around the iron core
or no short circuit
or so current does not flow in core
To prevent electric shock give [0]

[1]   20

5 (a) (i) 1 – Mercury   2 – Venus   [2]

(ii) Planets (orbit) (the Sun) in **same plane**   [1]
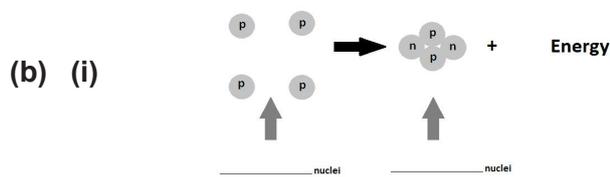Planets (orbit) (the Sun) in **same direction**   [1]   [2]

(iii) Provides the (centripetal) force   [1]
to keep planets **in orbit**/moving around the Sun   [1]   [2]

(iv) Counters or balances the outward force   [1]
Outward force identified as gas/radiation pressure   [1]   [2]

(v)

[1]

(vi) Mars   [1]

(b) (i)

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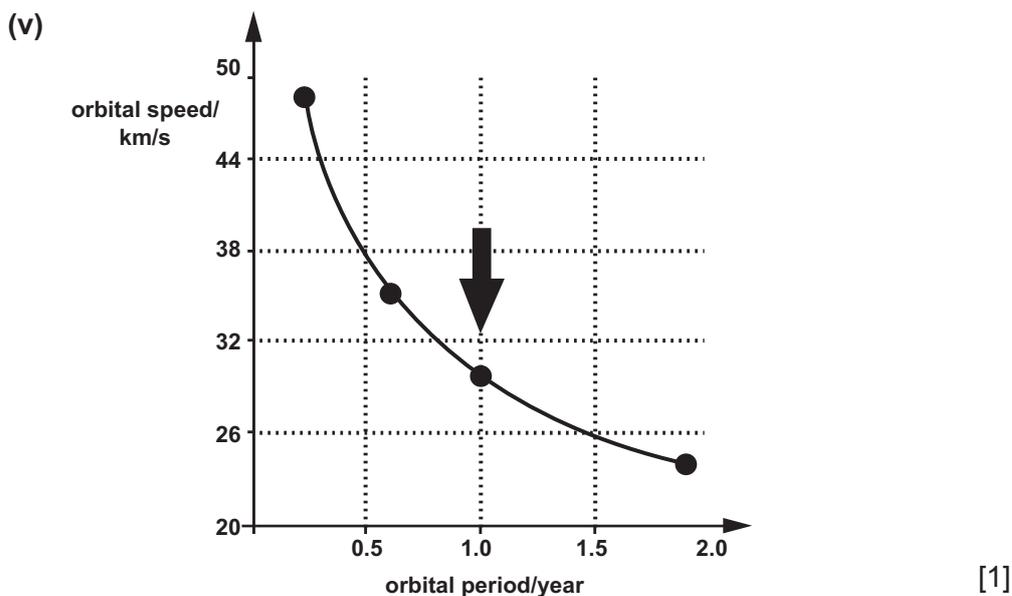
H or   He or
hydrogen nuclei   helium nuclei
(not deuterium or tritium)

[2]

(ii) Light/spectra (from the stars)   Not colour   [1]
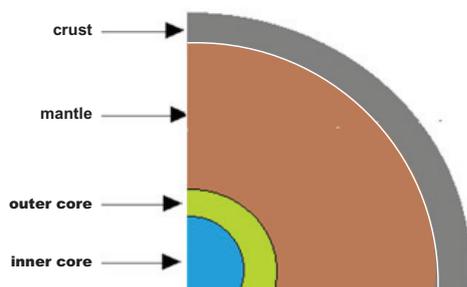
(c) (i) Cooling or temperature falls   [1]

(ii) Protons [1] and neutrons [1]   Not quarks   [2]

(iii) (Cosmic) **microwave background** (radiation)/CMBR or CBMR   [1]

(iv) Red shift   [1]
of **light** or **radiation** from other **galaxies** or stars in
other **galaxies**   [1]   [2]

(v) 12–15 billion years ago
or
12 000 million–15 000 million
or
A number between these limits   [1]   20

6 (a) (i)

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[4]

(ii) The region comprising of the crust [1] and **upper** [1] mantle   [2]
Upper or outer required for 2nd mark

(iii) The upper parts of the mantle the rock is hard/solid   [1]
Lower down the rock is soft or viscous or beginning to melt   [1]   [2]

(iv) Iron   [1]
Nickel   [1]   [2]

(v) Outer core is liquid   [1]
Inner core is solid   [1]   [2]

(b) The plates move (slowly) or collide   [1]
They stick/get caught   [1]
Eventually they jump/jerk/lurch/move suddenly   [1]   [3]   15

Total   **115**