Subject Details: Physics HL Paper 3 Markscheme

Mark Allocation

Candidates are required to answer questions from **TWO** of the Options **[2 % 30 marks]**.
Maximum total = **[60 marks]**.

1. A markscheme often has more marking points than the total allows. This is intentional.

2. Each marking point has a separate line and the end is shown by means of a semicolon (;).

3. An alternative answer or wording is indicated in the markscheme by a slash (/). Either wording can be accepted.

4. Words in brackets ( ) in the markscheme are not necessary to gain the mark.

5. Words that are underlined are essential for the mark.

6. The order of marking points does not have to be as in the markscheme, unless stated otherwise.

7. If the candidate's answer has the same "meaning" or can be clearly interpreted as being of equivalent significance, detail and validity as that in the markscheme then award the mark. Where this point is considered to be particularly relevant in a question it is emphasized by ***OWTTE*** (or words to that effect).

8. Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.

9. Occasionally, a part of a question may require an answer that is required for subsequent marking points. If an error is made in the first marking point then it should be penalized. However, if the incorrect answer is used correctly in subsequent marking points then **follow through** marks should be awarded. When marking indicate this by adding **ECF** (error carried forward) on the script.

10. Do **not** penalize candidates for errors in units or significant figures, **unless** it is specifically referred to in the markscheme.

Option E — Astrophysics

E1. (a) minor planet / rocky/icy/metallic body; ***[1]***

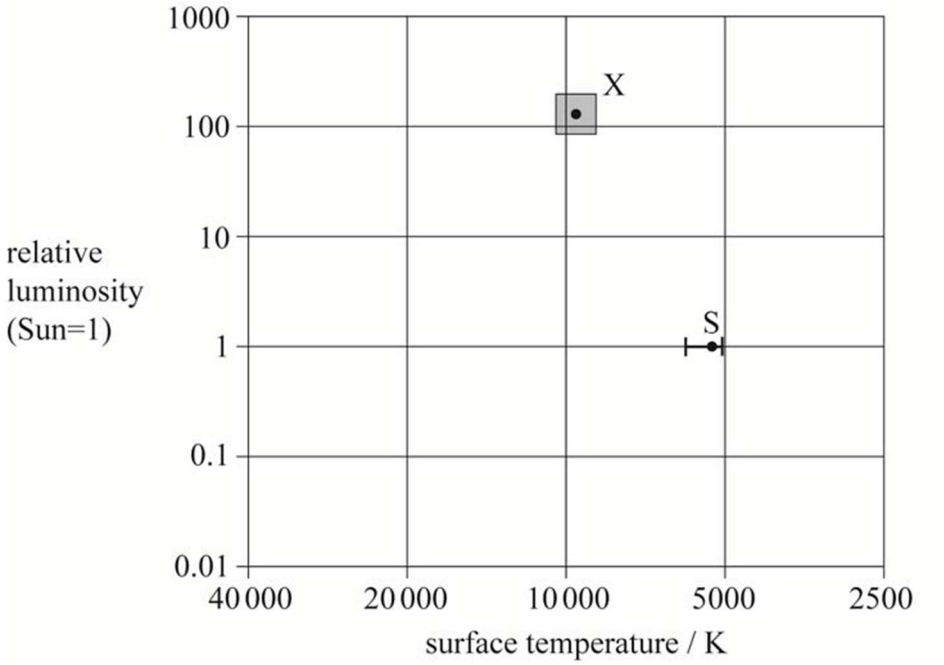
(b) situated between (orbits of) Mars and Jupiter; ***[1]***
Allow answers in terms of near-Earth asteroids or Trojan asteroids.

E2. (a) $T = \frac{2.9\times10^{-3}}{3.0\times10^{-7}}$;
9700 K; ***[2]***

(b) (i) $\frac{L_X}{L_S} = \frac{\sigma r_X^{\,2} T_X^{\,4}}{\sigma r_S^{\,2} T_S^{\,4}}$;
$= \frac{4.3_2 \times 9700_4}{5700^4}$;
$= 170$; ***[3]***
Accept answers that use $T = 10\,000\,K$ to give an answer of 190.

(ii) $\frac{M_X}{M_S} = \left[\frac{L_X}{L_S}\right]^{\frac{1}{3.5}}$;
$= [170]^{\frac{1}{3.5}}$;
$= 4.3$; ***[3]***
*Award **[3]** for a bald correct answer.*

(c)



(i) X marked correctly within range shown; ***[1]***

(ii) S marked correctly within range shown; ***[1]***
Allow ECF from (b)(ii).

(d) Chandrasekhar limit below which white dwarf stars can exist is 1.4 solar masses;
X is not going to form a white dwarf / X will not form a white dwarf if its final core/remnant mass is greater than the Chandrasekhar limit; ***[2]***
Allow ECF from (b)(ii).

E3. (a) (i) object of known luminosity/power; ***[1]***

(ii) luminosity varies with time in a regular way;
(average) luminosity related to period of variation;
high luminosity so visible from great distances; ***[2 max]***

(b) the period of the variation of luminosity/apparent brightness/apparent magnitude is measured;
the luminosity/absolute magnitude is determined from the period;
apparent magnitude/brightness is measured (on Earth);
$m - M = 5\lg\left(\frac{d}{10}\right)$ ***or*** $b = \frac{L}{4\pi d^2}$ is used to compute d; ***[3 max]***

E4. *infinite:* cosmic microwave background is observed consistent with cooling from a finite beginning / use of the Hubble constant to find universe age / bright universe not observed whereas an infinite universe would be completely bright;
uniform: significant empty distances visible between galaxies / reference to galactic clusters/super clusters / the greater the observed distance of galaxies, the greater the red-shift;
static: red-shift indicates expansion of universe / galaxies observed to be moving relative to Earth; ***[3]***

E5. (a) $v = 0.0094c$;
$2800\,\text{km s}^{-1}$; ***[2]***

(b) $13 - [-20] = 51\text{g}\left\lceil \frac{d}{10} \right\rceil$;

$10^{6.6} = \frac{d}{10}$;

39.8 Mpc; ***[3]***

(c) $\text{age of universe} = \frac{1}{H_0}$;

$\left(= \frac{d}{v} = 40\times10^{6} \times \frac{3.1\times10^{13}}{2.8\times10^{3}} \right) = 4.4\times10^{17}\text{s}\ \left(= 1.4\times10^{10}\text{yr}\right)$; ***[2]***

Option F — Communications

F1. (a) (i) 0.0006 MHz ***or*** 600 Hz; ***[1]***

(ii) 0.0012 MHz ***or*** 1200 Hz; ***[1]***

(b) amplitude is constant in FM transmission;
noise/interference tends to affect the amplitude of the carrier wave only;
receiver compensates for any changes in the (received) signal; ***[3]***

(c) FM has shorter range than AM;
higher frequencies required;
equipment has higher cost (because more elaborate circuitry);
wider bandwidth needed / fewer channels possible; *(not "higher bandwidth")* ***[2 max]***

F2. (a) A: clock;
B: analogue-to-digital converter / C: parallel-to-serial converter; ***[2]***

(b) (i)

Time / ms	Digital output equivalent
3.5	010
4.0	011

times both correct;
digital values both correct; ***[2]***

(ii) can more closely conform to variation in analogue / closer to rounded values / final output more faithful reproduction of input; ***[1]***

以上内容仅为本文档的试下载部分，为可阅读页数的一半内容。如要下载或阅读全文，请访问：https://d.book118.com/476120200141010033