CATHOLIC SECONDARY SCHOOLS ASSOCIATION

2001 TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

PHYSICS MARKING GUIDELINES/SOLUTIONS

Section I Part A

Questions 1 – 15 **1 mark each**

QUESTION	ANSWER	OUTCOMES
1	A	H6, H7, H9
2	B	H4
3	B	H9, H12, H14
4	B	H6, H12, H14
5	B	H6, H12
6	A	H7, H14
7	B	H9, H12
8	C	H9, H10, H14
9	C	H9
10	C	H2
11	B	H9
12	B	H9, H14
13	A	H7, H9
14	C	H9, H14
15	B	H7, H10, H12

Section I Part B

Question 16

(a) Outcomes Assessed: H14

1 mark for correct answer – 1 day or 24 hours (or equivalent)

(b) Outcomes Assessed: H2, H9 & H14

1 mark for use of correct equation & calculation of total distance from Earth's centre (42300 km approx)

1 mark for correct calculation of height above Earth's surface (35900 km approx)

(c) Outcomes Assessed: H2, H9 & H14

Answers scoring 2 marks must mention something like: (i) the planet's gravity accelerates the space probe on approach and decelerates it on departure so that the departure speed relative to the planet is the same as its approach speed; & (ii) but the probe takes a little of the planet's angular momentum with it, thus changing its velocity relative to the sun.

Answers scoring 1 mark would mention just one of the points above or perhaps even say something like: the space probe has to approach close enough to the planet to enter its gravitational field but be moving fast enough not to get captured into planetary orbit.

Question 17

(a) Outcomes Assessed: H1 & H13

Answers scoring 2 marks must mention something like: (i) Galileo argued that projectile motion was a compound motion made up of a horizontal motion which had a steady speed in a fixed direction and a vertical motion of downward acceleration; & (ii) the path of any particle undergoing such compound motion is a parabola.

Answers scoring 1 mark would mention just one of the above points.

(b) Outcomes Assessed: H2, H12 & H13

1 mark should be given for showing a theoretical calculation of horizontal & vertical components of the velocity at a particular time chosen from the table;
1 mark for showing a theoretical calculation of the total velocity (magnitude only) at the chosen time;
1 mark for some appropriate comment that indicates that you would test all the experimental values in this way to ascertain their agreement or otherwise with the theoretical values. OR Markers may prefer to simply give 1 mark each for the horizontal & vertical component calculations mentioned above and not require any comment, plus 1 mark for verifying the magnitude of the velocity.

(c) Outcomes Assessed: H2 & H6

1 mark for calculation of correct weight from F = mg. (0.192 N)

Question18

(a) Outcomes Assessed: H9 & H13

1 mark total for naming one of the following: distance, van Allen radiation belts & sunspot activity.

(b) Outcomes Assessed: H2, H9 & H13

Students should be able to mention at least two differences between microwave technology & radiowave technology that make microwave technology the preferred one. See below. 1 mark for each difference. Students might also mention some similarities between the technologies but these are of secondary importance in answering this question. Marks are left to the discretion of the marker.

(c) Outcomes Assessed: H4, H6 & H13

1 mark for correct calculation of the time to alpha-C (43300 years approx).
1 mark for an appropriate comment indicating that velocity is a limiting factor for long-distance space travel at the moment.

Notes for (b):

Microwaves are capable of penetrating the ionosphere and therefore of reaching space probes & satellites, whereas radiowaves cannot. Microwaves are higher frequency than radiowaves and can therefore carry more information per second than radiowaves, which means it takes less time to transmit instructions or data to space probes or satellites using microwaves than using radiowaves. Both of these differences between the two technologies make microwaves the preferred technology for space travel.

Question 19

(a) Outcome assessed: H9

1 mark each for the magnitude (4×10^{4} Vm^{-1}) and direction (B to A)

(b) Outcomes assessed: H9

1 mark for direction (D to C)

(c) Outcomes assessed: H9

1 mark for deriving v = E/B from equating forces

(d) Outcomes assessed: H7, H13

1 mark for calculating the velocity ($2\times10^{8}ms^{-1}$)

1 mark for calculating KE ($1.8\times10^{-14}J$)

Question 20

(a) Outcomes assessed: H6, H9, H13

1 mark for definition (space-time continuum)

(b) Outcomes assessed: H6

1 mark each for correctly calculating lengths as

i.) 30m ii.) 25.98 m

(c) Outcomes assessed: H1, H4

1 mark for any of – time dilation, mass increase, relativity of simultaneity- up to 2 marks

Question 21

(a) Outcomes assessed: H11

2 marks for naming potential difference as the independent variable, current as the dependent variable, and resistance as the constant quantity

1 mark for naming at least two of the above correctly.

(b) Outcomes assessed: H2, H8, H10

1 mark for stating that emission velocity of photoelectrons is higher for violet light

1 mark for explanation mentioning $c = f\lambda$ and $E = hf$.

(c) Outcomes assessed: H2, H8, H10

1 mark for correct use of formulae

1 mark for accurate calculation ($E = 4.97\times10^{-19}J$)

stion 22

(a) Outcomes assessed: . H1

1 mark for statement of the condition that the energy gap between the conduction band and the valence band is comparable to thermal energies

1 mark for stating that electrons travel in the conduction band whereas holes travel in the valence band

(b) Outcomes assessed: H9

1 mark for explaining that potential difference of a battery gives rise to a field which exerts a force on charged objects

1 mark for correctly explaining that electrons move in the opposite direction to the electric field while holes move in the direction of the field

(c) Outcomes assessed: H1

1 mark for identification of any two of germanium, silicon and gallium arsenide.

Question 23

(a) Outcomes assessed: H3, H5, H13

1 mark for either drift velocity or random linear motion

(b) Outcomes assessed: H3, H5, H13

2 marks for describing drift velocity as the slow ordered motion under the influence of the external field

(c) Outcomes assessed: H5, H13

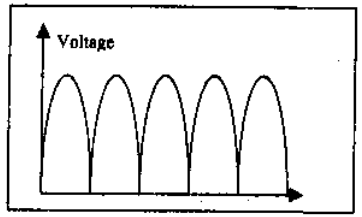
2 marks for correctly calculating the four values (12.6°, 25.9°, 40.9°,60.8°)

1 mark if a minimum of two values are calculated OR if it is recognised that four values need to be calculated

Question 24

(a) Outcomes assessed: H2, H9, H13

1 mark for a sketch showing the essential features



(b) Outcomes assessed: H9, H13

1 mark for indicating the role if keeping the same direction for the output current.

(c) Outcomes assessed: H3, H7, H13, H14

1 mark per correct reason. Possible correct statements include: coils spinning through magnetic field; changing magnetic flux through coils; sides of coil cutting lines of flux;....

(d) Outcomes assessed: H4, H7, H13

1 mark for a correct reason. Could include easier to transform AC for transmission; Less power loss in Ac transmission cf. DC transmission; smooth DC difficult to generate;....

Question 25

(a) Outcomes assessed: H9, H13

1 mark for each of -Length of conductor and velocity

(b) Outcomes assessed: H9, H13

1 mark for a statement which points out that magnetic flux density is the number of magnetic fi lines per unit area (=B) and flux is the total number of field lines passing through the area (=B.

(c) Outcomes assessed: H7, H9, H13

rate of change of magnetic flux = $\frac{\text{flux change}}{\text{time}} = \frac{2 \times 3.2 \times 10^{-5}}{0.2} = 3.2 \times 10^{-4}$

1 mark for the concept (equation); 1 mark for recognising flux *change* is twice the original flux.

Question 26

(a) Outcomes assessed: H4, H7, H9

$P = \frac{V^2}{R} = \frac{415^2}{(500/20)\times 1} = 6.9$ kW

1 mark for the correct equation; 1 mark for the correct substitution.

(b) Outcomes assessed: H4, H7, H13

$\frac{Np}{Ns} = \frac{415}{240}$ 1 mark for use of the ratio concept, 1 mark for having the ratio correct

(c) Outcomes assessed: H4, H7, H9, H13

i. 1 mark - To act as a coolant

ii. 1 mark - By having laminations in the core