3IB Physics SL + HL. Test 23-10-2008 TM – *Answers*

1. M03 S1: 1 - B

2. M03 S1: 23, H1: 25 - A

3. M03 S1: 24, H1: 26 - B

4. M03 S1: 25 - B

5. N03 H1: 23 - A

6. N03 S1: 18 - B

7. N03 S1: 22 - A

8. N03 S1: 23 - D

9. M03 S2/H2: A1 Marks: 12

(a) bubbles rise at constant rate / constant temperature using a thermometer; ***[1]***

(b) can check that rate of boiling is constant;
because the two masses should be equal; ***[2]***

(c) (i) reasonable line drawn; ***[1]***

(ii) triangle for gradient with hypotenuse at least half length of line;
some working shown (*e.g.* coordinates used made clear);
answer 12 (W g^{-1}) ± 1; ***[3]***

(d) gradient = $\frac{L}{200}$;
L = 2400 *allow ecf from (c)(ii)*;
correct unit J g^{-1}; ***[3]***

(e) heat energy losses / systematic error;
to the atmosphere / any other detail; ***[2]***

10. M03 S2/(H2): B1 Marks: 25

(a) ray: direction in which wave (energy) is travelling;
wavefront: line joining (neighbouring) points that have the same phase / displacement /
Or suitable reference to Huygen's principle;
ray is normal to a wavefront; ***[3]***

(b) (i) wavefront parallel to D; ***[1]***

(ii) frequency is constant;
since $v = f\lambda, v \propto \lambda$;
wavelength larger in medium I, **hence** higher speed in medium I; ***[3]***
Allow solution based on angles marked on diagram or speed of wavefronts.

(iii) ratio = $\frac{v_I}{v_R} = \frac{\lambda_I}{\lambda_R}$ (or based on Snell's law);
$= \frac{3.0}{1.5} = 2.0$ *allow* ± 0.5; ***[2]***

(c) (i) velocity / displacement / direction in (+) and (–) directions;
idea of periodity; ***[2]***

(ii) period = 3.0 ms;
frequency = $\frac{1}{T}$ = 330 Hz; ***[2]***

(iii) *Accept any one of the following.*
at time t = 0, 1.5 ms, 3.0 ms, 4.5 ms, *etc.* ; ***[1]***

(iv) area of half-loop = 140 ± 10 squares / mean $v = 4.0\ \text{m s}^{-1}$ *accept* ± 0.2;
$= 140 \times 0.4 \times 0.1 \times 10^{-3}$ / $4.0 \times 1.5 \times 10^{-3}$;
$= 5.6 \times 10^{-3}$ m / 6.0×10^{-3} m;
Award ***[1]*** *for area of triangle.* ***[2]***

(v) (twice) the amplitude;
Allow distance moved in 1.5 m s. ***[1]***

(d) travelling wave transfers energy;
standing wave does not transfer energy;
amplitude same for all particles in a travelling wave;
amplitude varies from zero to a maximum in a standing wave; ***[4]***

(e) (i) distance shown as length of two loops; ***[1]***

(ii) wavelength = $\frac{2}{5} \times 120 = 48$ cm;
$v = f\lambda = 250 \times 0.48$;
$= 120\ \text{m s}^{-1}$; ***[3]***

11. M02 (S2)/H2: A3 Marks: 7

(a) (i) 6 V divides equally between R_B, R_C and R_D; ***[1]***

therefore voltage across $R_C = 2$ V; ***[1]***

or they might do it via current, total current $\frac{6}{7.5}$; ***[1]***

$\frac{1}{4}$ of this flows through R_C therefore voltage across $R_C = \left(\frac{6}{7.5}\right) \times \frac{1}{4} \times 10 = 2\,\text{V}$; ***[1]***

[max 2]

(ii) 3 V ***[max 1]***

(iii) connect voltmeter across R_B and then R_D; ***[1]***

the connection that gives a zero reading indicates which resistor is short circuit; ***[1]***

OWTTE

[max 2]

(b) R_C has gone open circuit; ***[1]***

and R_B and R_D have both gone short circuit; ***[1]***

[max 2]