OCR

RECOGNISING ACHIEVEMENT

WAVE PROPERTIES

Mark Scheme 2823/01
January 2005

1. (a)   symbol c represents speed of light/wave --M1
c_i = speed of light in air/vacuum (or speed of incident ray or WTTE) **AND**
c_r = speed of light in medium (or speed of refracted ray or WTTE) ----------A1   [2]

(b) (i) recall of R.I = sini/sinr -- C1
correct substitution into this formula : e.g. 1.47 = sin 50/sinr ----------------- C1
r = 31 (or 31.4 or 31.42) degrees -- A1
(NB 50/1.47 = 34.01)

(ii) r = 0 degrees --- A1
                                                                                              [4]
                                                                                                          [6]

---

2. (a) (i) labelled diagram with light from dense to less dense medium (or stated)   B1
critical angle correctly labelled: refracted ray on surface (arrows not needed)--   B1
{written description with no diagram scores 1 mark max).   [2]

(ii) ray shown to be INTERNALLY reflected (ignore angles, arrows not needed) B1
diagram with incident angle > than critical angle and symmetrical (by eye)-   B1
{written description with no diagram scores 1 mark max).   [2]

(b) valid <u>substitution</u> in RI = 1/sinC: e.g. 1.76 = 1/sinC -------------------------   C1
C = 35 (or 34.6) $^\circ$ --   A1   [2]

                                                                                                          [6]

---

3. (a)   (i) any valid example - e.g. LIGHT, MICROWAVES (any em waves) ------   B1 [1]
(allow "water" /"sea" but reject 'slinky' unless explained/shown)

(ii) any valid example: e.g. SOUND ---B1 [1]
(allow 'pressure wave'; reject "water" and 'slinky' unless explained/shown)

(b)(i) *transverse* = vibrations perpendicular to wave (direction) (WTTE) ----------B1 [1]
(allow "motion is perpendicular to wave", reject vague answers: e.g "vibrate up+down")

(ii) *longitudinal* = vibrations parallel to wave direction (WTTE) -------------------- B1 [1]
(allow "motion is perpendicular to wave" reject vague answers: e.g "vibrate back and for)

Wave phenomenon	Transverse waves	Longitudinal waves		
REFLECTION	YES	YES		
REFRACTION	YES	YES	B1	
DIFFRACTION	YES	YES	B1	[3]
POLARISATION	YES	NO	B1	

                                                                                                          [7]

---

4. (a) (i) amplitude correctly labelled (by **A** or in words) ———————————— B1 [1]
(reject "A" as a point i.e. with no arrows)

(ii) wavelength correctly labelled (by λ or in words) ————————— B1 [1]

(b) (i) same shape ————————————————————————————— B1
moved slightly to the right consistently drawn for both waves ————— B1 [2]
(do not allow shift of more than ¼ wavelength)

(ii) movement is VERTICAL ———————————————————————— M1
Q moves UP ↑ <u>AND</u> S moves DOWN ↓ shown ————————— A1 [2]

(c) phase difference = 180° (degrees) OR π ————————————————— B1 [1]
{allow "in antiphase" do not allow "out of phase"}

(d) (i) recall of T = 1/f ————————————————————————————— C1
T = 1/25 = 0.04 s ———————————————————————— A1 [2]

(ii) recall of v= fλ ———————————————————————————— C1
valid substitution: e.g. v = 25 x .036 ——————————————— C1
v = 0.90 ms^{-1} ————————————————————— A1 [3]
(there are 2 possible errors – incorrect wavelength and wrong units, so
v = 90 m/s scores 2 marks
v = 0.45 m/s scores 2 marks but allow 3 marks for ecf from cand's λ in (a) (ii)
v = 45 m/s scores 1 mark but allow 2 marks for ecf from cand's λ in (a) (ii)

(e) (i) any valid suggestion: e.g. change <u>depth of water</u> ——————————— B1 [1]

(ii) wavelength will reduce ———————————————————————— C1
halved
{OR new wavelength = 1.8cm OR half cand's value shown in (d) ii} ——— A1 [2]

[15]

7]

5. (a) <u>COHERENT</u> (allow coherence) --- B1 [1]

   (b) *constructive interference:* valid diagram and/or explanation: e.g.

      when waves (from coherent sources) meet in phase (or $n\lambda$ path diff.) -------- B1
      waves reinforce: resultant has increased displacement/amplitude ------------- B1
      correctly shown on diagram or stated

      destructive interference: valid diagram and/or explanation: e.g.
      when waves meet in antiphase/180° phase diff. {or $(n+1/2)\lambda$ path diff.} --- B1
      waves cancel: resultant has reduced displacement/amplitude -------------- B1
      correctly shown on diagram or stated

                                                           [4]

   (c) *diagram*:
      laser OR light source <u>and single-slit</u> in front of double slit ------------------ B1
      screen (WTTE) (or travelling microscope) behind double-slit -------------- B1
      (if 'screen' is not labelled mark can be obtained by reference to 'screen' in text)

      measurements:
      <u>measure</u> distance between double-slit and screen ---------------------------- B1
      <u>measure</u> distance between neighbouring dark/bright images --------------- B1
      (allow 'fringe spacing' or measure distance for n fringes)

      formula:
      recall of $\lambda = ax/D$ --- B1

      ALL symbols correctly defined
         a = distance between slits --}
         x = fringe separation (WTTE) ---} B1
         D = distance between slits and screen --------------------------------------}　　[6]
(If candidate uses their own symbols they must be used correctly to score the formula recall mark)
(do not penalise careless use of d and D: i.e. being interposed)

                                                                              [11]