Question	Answer	Marks	Guidance
1	**Level 3: (5 – 6 marks)** **Answer shows understanding of** **For higher frequencies the speed slows / direction changes the most.** **AND for higher refractive index the speed slows / direction changes the most.** Quality of written communication does not impede communication of the science at this level. **Level 2: (3 – 4 marks)** **Answer shows understanding of the nature of the colour of light.** Quality of written communication partly impedes communication of the science at this level. **Level 1: (1 – 2 marks)** **Answer shows a simple appreciation of the nature of light.** Quality of written communication impedes communication of the science at this level. **Level 0: (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted up to grade A*** **NB. Answers can be given (ORA) in terms of red light.** **Indicative scientific points may include:** **Level 3:** • violet light has highest frequency / shortest wavelength and speed slows most / direction changes the most / AW • violet light has highest refractive index and slows most / direction changes the most / AW **Level 2:** • EITHER violet light slows down most • OR violet light has higher frequency / shorter wavelength • OR violet light has higher refractive index **Level 1:** • EITHER light slows down when entering glass • OR different colours have different speed changes • OR different colours have different refractive index • OR different colours have different frequencies / wavelength **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	Total	**6**	

Question			Answer	Marks	Guidance
2	(a)		2.25×10^8 or 2.3×10^8 (m / s) (2) **but if answer is incorrect** 3×10^8 / 1.333 (1)	2	**allow** 225(056264.1) (2) **allow** 225 563 909.8 (2)
	(b)		glass – arsenic trisulphide (1)	1	
	(c)		blue light is **refracted** more / ORA (1) blue light slows down more (than red) / ORA (1)	2	**eg.** red refracted less than blue (1) **ignore** blue bends / deviates more **allow** blue has a shorter wavelength (1) **ignore** frequency **allow** higher level answers in terms of the equation: n = speed in vacuum / speed in medium eg smaller speed in glass has larger refractive index. Red light travels faster than blue so blue has larger n. (2)
			Total	**5**	

Question	Answer	Marks	Guidance
3	**Level 3: (5 – 6 marks)** **Describes the nature of laser beam AND explains where and how information is stored AND explains how information is read from the disc.** Quality of written communication does not impede communication of the science at this level. **Level 2: (3 – 4 marks)** **Describes any two from:** **the nature of laser beam OR** **explains where and how information is stored OR explains how information is read from the disc.** Quality of written communication partly impedes communication of the science at this level. **Level 1: (1 – 2 marks)** **Describes any one from:** **the nature of laser beam OR** **explains where and how information is stored OR** **explains how information is read from the disc.** . Quality of written communication impedes communication of the science at this level. **Level 0: (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted up to grade A*** **Indicative scientific points may include:** **Nature of a laser beam** • **EITHER** laser beam is coherent • **OR** is in phase or in sync **AND** has same frequency / wavelength / is monochromatic **Where and how information is stored** • storage by pits and bumps / lands **How information is read from the disc** • read by reflection of laser from pits and / or bumps or lands (collected by receiver) **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	Total	**6**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>4</td><td>(a)</td><td>(i)</td><td>1.5 x 10^{14} (Hz) (2)

but if answer is incorrect

2.2 x 10^{8} ÷ 1.5 x 10^{-6} (1)</td><td>2</td><td>1.47 x 10^{14} (2)
allow other Hz prefixes eg 1.5 x 10^{8} MHz/150THz
if multiple clearly shown on answer line

allow 1.4666 x 10^{14} (1)
allow 146666660000000 (1)</td></tr>
<tr><td></td><td></td><td>(ii)</td><td><table><tr><th></th><th>> i fibre</th><th>= in fibre</th><th>< in fibre</th></tr><tr><td>speed of IR in air</td><td>✓</td><td></td><td></td></tr><tr><td>wavelength of IR in air</td><td>✓</td><td></td><td></td></tr><tr><td>frequency of IR in air</td><td></td><td>✓</td><td></td></tr></table></td><td>2</td><td>all 3 correct (2)

1 or 2 correct (1)</td></tr>
<tr><td></td><td>(b)</td><td></td><td>max one from standard demand marks:
rapid (high rate) of transmission of data (1)
idea that it is easier to remove noise (1)

any two from higher demand marks:
multiple signals / more information transmitted / multiplexing (1)
output signal / sound / picture is clearer (1)

noise not recognised or amplified (1)</td><td>2</td><td>ignore interference can be removed

ignore less interference in signal

allow interference is not recognised (1)</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>6</td><td></td></tr>
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