SQA Am Answers

7. E
8. C
9. C
10. A
11. E
12. A
13. C

7	a	i	A = 2u + 1d	1
			B = 1u + 2d	1
		ii	gluon	1
	b	i	beta decay	1

9	a	i	$\Delta m = 4 \times 1{\cdot}673 \times 10^{-27} - 6{\cdot}646 \times 10^{-27}$ $\Delta m = 4{\cdot}6 \times 10^{-29} (kg)$ (1) $E = mc^2$ (1) $E = 4{\cdot}6 \times 10^{-29} \times (3{\cdot}00 \times 10^{8})^2$ (1) $E = 4{\cdot}14 \times 10^{-12}$ J (1)	4	Accept $4{\cdot}1 \times 10^{-12}$ J
		ii	1 kg hydrogen has $\frac{0{\cdot}20}{1{\cdot}673 \times 10^{-27}} = 1{\cdot}195 \times 10^{26}$ atoms (1) Provides $\frac{1{\cdot}195 \times 10^{26}}{4} = 0{\cdot}2989 \times 10^{26}$ reactions (1) Releases $0{\cdot}2989 \times 10^{26} \times 4{\cdot}14 \times 10^{-12}$ $= 1{\cdot}2 \times 10^{14}$ J (1) (1)	3	the division by 4 can be done in the last line Allow 1, 1·24, 1·247 ($\times 10^{14}$ J)
		iii	Large amount of energy released results in **very** high temperatures OR Strong magnetic fields are required for containment	1	

	b		$m_{Rn}v_{Rn} = -m_\alpha v_\alpha$ (1) $3 \cdot 653 \times 10^{-25} \times v_{Rn} = -6 \cdot 645 \times 10^{-27} \times 1 \cdot 46 \times 10^{7}$ (1) $v_{Rn} = 2 \cdot 656 \times 10^{5}\,\mathrm{m\,s^{-1}}$ (1)	3	OR $m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$ $0 = 3 \cdot 653 \times 10^{-25} \times v_{Rn} + 6 \cdot 645 \times 10^{-27} \times 1 \cdot 46 \times 10^{7}$ $v_{Rn} = -2.656 \times 10^{5}\,\mathrm{m\,s^{-1}}$ 1 for equation 1 for sub 1 for answer 2 velocities must have opposite directions else max 1 mark
10	a		Blue light has higher frequency/energy per photon than red light. (1) Photons of red light do not have enough energy to eject electrons (1)	2	Or similar statement comparing blue and red light Or similar statement in terms of threshold frequency or work function
	b		$E_k = hf - hf_0$ (1) $= (6{\cdot}63 \times 10^{-34} \times 7{\cdot}0 \times 10^{14})$ - $2{\cdot}0 \times 10^{-19}$ (1) $= 2{\cdot}6 \times 10^{-19}$ J (1)	3	Accept 3, 2·64, 2·641 but not 3·0
8	a	i	$W = QV$ or $E_w = QV$ (1) $E_w = 1{\cdot}6 \times 10^{-19} \times 35000$ (1) $E_w = 5{\cdot}6 \times 10^{-15}$ J	2	
		ii	Original $E_k = ½\,mv^2$ (1) $E_k = ½\,(1{\cdot}673 \times 10^{-27})(1{\cdot}2 \times 10^{6})^2$ (1) $E_k = 1{\cdot}20 \times 10^{-15}$ (J) New $E_k = 1{\cdot}20 \times 10^{-15} + 5{\cdot}6 \times 10^{-15}$ (J) New $E_k = 6{\cdot}8 \times 10^{-15}$ (J) (1) $E_k = ½\,mv^2$ $6{\cdot}8 \times 10^{-15} = ½\,(1{\cdot}673 \times 10^{-27})v^2$ (1) $v = 2{\cdot}9 \times 10^{6}\,\mathrm{m\,s^{-1}}$ (1)	5	$(1{\cdot}20456 \times 10^{-15})$ $(6{\cdot}80456 \times 10^{-15})$ Accept 3, 2·85, 2·852 but not 3·0
11	a		Light with fixed/no phase difference.	1	
	b	i	Bright fringes are produced by waves meeting in phase/crest to crest/trough to trough	1	"Waves produced by constructive interference" does not answer question (0)

		ii	$\Delta x = \frac{\lambda D}{d}$ (1) $\frac{9{\cdot}5 \times 10^{-3}}{4} = \frac{633 \times 10^{-9} \times 0{\cdot}750}{d}$ (2) $d = 2{\cdot}0 \times 10^{-4}$ m (1)	4	**(1)** data value of λ **(1)** substitution of values including division by 4 If not divided by 4 then max **(1)** data value of λ Accept 2, 1.999 ($\times 10^{-4}$ m)
		iii	$\%uncert\Delta x = \frac{0{\cdot}2 \times 100}{9{\cdot}5 \times 10^{-3}} = 2{\cdot}1\%$ (1) $\%uncert D = \frac{0{\cdot}002 \times 100}{0{\cdot}750} = 0{\cdot}27\%$ **(1)** Improve precision in measurement of Δx (1)	3	In order to gain final mark must have shown two calcuations of the correct form, percentage or fractional Award final mark even if D identified due to wrong arithmetic
12	a	i	Labels (quantities and units)and scale (1) Points correctly plotted (1) Correct best fit line (1)	3	Non-linear scale = 0 marks Allow 1/2 division tolerance in plotting points
		ii	Gradient of graph (1) Refractive index = 1·50 (1)	2	1 mark for knowing to calculate the gradient of best fit line. 1 mark for correct value.
		iii	Repeated measurements Increased range of measurements Narrower beam of light Increase the number of values within the range Protractor with more precise scale eg $\frac{1}{2}^{\circ}$ divisions	2	1 mark each up to a maximum of 2 marks. Note - do not accept 'bigger protractor'
	b		$\sin\theta_c = \frac{1}{n}$ (1) $\theta_c = \sin^{-1}\frac{1}{1{\cdot}54}$ (1) $\theta_c = 40{\cdot}5^{\circ}$ (1)	3	Accept 40, 40·49, 40·493