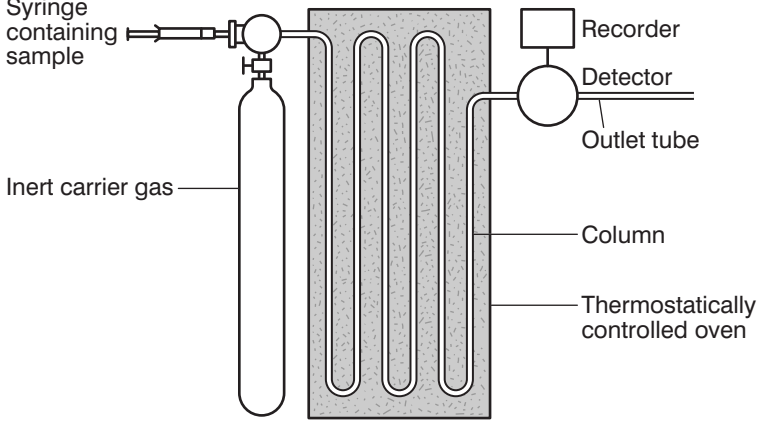
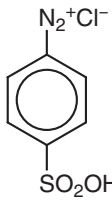
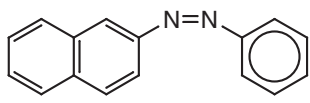


Answers to Colour by Design End of Unit Test

Q	Answer with marks	Marking suggestions
1(a) (i)	A absorbs in the red/orange and reflects blue (1); B is the other way round (1)	Or vice versa
1(a) (ii)	Complex ion (1)	
1(b) (i)	$\text{Pb}^{2+}(\text{aq}) + \text{CrO}_4^{2-}(\text{aq}) \rightarrow \text{PbCrO}_4(\text{s})$ (1) for left-hand side; (1) for right-hand side; (1) for state symbols	Award third mark if equation has (aq) + (aq) → (s) (+ (aq))
1(b) (ii)	The shade of colour could depend on <i>one</i> of (1): particle size polymorphic substance pH/presence of dichromate	
1(b) (iii)	Lines/frequencies in an atomic emission spectrum result from electrons falling between energy levels (1); different atoms have different energy levels/give rise to characteristic lines/frequencies (1); hence characteristic lines/frequencies for lead can be identified (1)	
1(c) (i)	$\begin{array}{c} \text{OH} \\ \\ \text{HOH}_2\text{C}-\text{C}-\text{CH}_2\text{OH} \\ \\ \text{H} \end{array}$ (1) OH group(s) (1) structure completely correct	
1(c) (ii)	 (1) for basic diagram of sample, column and detector (1) for detail and labels: carrier gas, syringe for sample, thermostatically controlled oven Vapours take different times to come through column (1); time is characteristic of a particular substance (1)	
1(c) (iii)	Structural feature is (C=C) double bond (1); these react with oxygen (1); to give cross-links (1)	

Q	Answer with marks	Marking suggestions
2(a) (i)	Aromatic (1)	Allow arenes
2(a) (ii)	The electrons are delocalised (1); into a ring (1); above and below the ring of carbon atoms (1)	
2(b) (i)	Electrons (1); are promoted up energy levels (1)	
2(b) (ii)	Benzene has greater differences between its energy levels (1); hence it absorbs in the u.v. (1); not visible (1)	
2(c) (i)	Concentrated nitric (1) and concentrated sulphuric acid (1); < 55 °C (1)	
2(c) (ii)	Electrophilic (1); substitution (1)	
2(d)	Concentrated sulphuric acid (1); reflux (1)	Second mark only scored if acid mentioned

2(e) (i)	 <p>(1) indication that it is NH_2 which reacts and SO_2OH is unchanged; (1) for N_2^+; (1) for Cl^-</p>	N_2Cl scores both of last two marks
2(e) (ii)	Coupling (1)	
2(f)	$\text{SO}_3^-(\text{Na}^+)$ (1); ionic compounds are more soluble in water (1); ions attract water molecules/ions become hydrated (1)	
2(g)	$\text{NH}_2/\text{NH}_3^+$ (1); SO_3^- (1)	

Q	Answer with marks	Marking suggestions
3(a) (i)	Covalent (1)	
3(a) (ii)	Hydrogen bond (1)	In the context of the question allow 'hydrogen'
3(b)	Dye B (1); because it can hydrogen bond to water (1); more readily than to the fibre (1)	Allow for (1) 'because its intermolecular forces are weak(er)'
3(c) (i)	The part of the molecule responsible for its colour (1)	
3(c) (ii)	 <p>(1)</p>	
3(c) (iii)	Two arene/aromatic systems (<i>or words to that effect</i>) (1); connected by $-\text{N}=\text{N}-$ (1)	
3(d) (i)	CH_3COCl (1); ethanoyl chloride (1); aluminium chloride (1)	
3(d) (ii)	Friedel-Crafts (1)	
3(d) (iii)	Alkyl (1); chloroalkane/specific chloroalkane (name or formula) (1)	
3(d) (iv)	It extends the chromophore/increases the delocalisation (1)	