1. (a) (i) $C1_2(aq)/(g) + 2I^-(aq) \rightarrow 2Cl^-(aq) + I_2(aq)/(s)$
Formulae – including charges **(1)**
Balancing and all state symbols **(1)** *ALLOW multiples* 2

(ii) Brown/yellow/red
OR any combination of the three eg red-brown.
NOT "orange" *on its own or as a combination of the above* 1

(b) (i) –1/1–)
+5/5+) ✓ 1

(ii) +4/4+)
+6/6+) ✓ 1

(iii) $3SO_2(aq)$ $3SO_4^{2-}(aq)$ **(1)**
$3H_2O(l)$ $6H^+(aq)$ **(1)**
ALLOW multiples 2

(c) (i) Separating funnel **(1)**
upper hydrocarbon layer **(1)**
pink/purple **(1)** 3

(ii) Evaporate / Distil **solvent** 1

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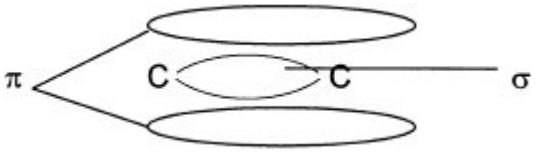
2. (a) (i) $C_2H_6(g)/(l) \rightarrow C_2H_4(g) + H_2(g)$
If a state symbol is missing **(0)**
If (aq) **(0)** 1

(ii) At high pressure reaction goes in direction to reduce pressure/to oppose change by Le Chatelier's principle **(1)**
towards side with fewer molecules/moles **(1)** 2

(b) Shapes of orbitals between and above carbon



If p orbitals drawn msut show overlapping

Shapes **(1)** ACCEPT crescents for p bonds NOT lines for s bond 2
Labels **(1)**

(c) Addition of bromine **water/solution (1)**
from yellow/brown/orange to **colourless (1)**
OR
acidified potassium manganate(VII) **(1)**
from pink/purple to **colourless (1)** 2

(d) Addition **(1)**
Elecrophilic/electrophile *OR* appropriate *explanation* **(1)** 2

(e) (i) Potassium/sodium hydroxide/KOH/NaOH **(1)**
NOT hydroxide/OH^- ions
Reflux/heat/warm **and** ethanol/ethanolic/
alcoholic solution **(1)** 2

(ii) Van der Waals **and** (permanent) dipole-(permanent) dipole 1

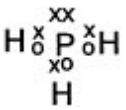
(f) (i) $nCH_2(=)CHCl \rightarrow (–CH_2–CHCl–)_n$

Formulae **(1)**
Balancing ie n's **(1)** 2

(ii) Window frames
doors
floor coverings
electrical insulation
records/LPs
guttering
pipes
'cling film'
waterproof/mock leather clothing
shiny handbags
vinyl/washable wall paper
furniture covers
table cloths 2

[16]

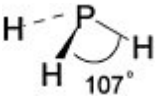
3. (a) (i)



1

ACCEPT all dots/crosses

(ii)



Trigonal pyramid/Tetrahedral/'Three leg stool' shape **(1)** –
must be some attempt at 3D or correct name
107° *ALLOW* 92-108 **(1)** 2

(iii) repulsion between four pairs of electrons gives tetrahedral shape **(1)**)
Greater repulsion of non-bonding electrons/lone pair closes down tetrahedral bond angle **(1)** 2

(b) (i) $PH_3(g) \rightarrow P(g) + 3H(g)$ 1

(ii) Hess applied **(1)**
Multiples **(1)**
Correct answer + 963(.2)/960 **kJ mol^{-1} (1)** 3

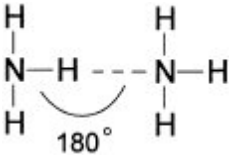
(iii) Answer to (ii) divided by 3
+ 321(.1)/320 **kJ mol^{-1}** 1

[10]

4. (a) Phosphine has more electrons 1

(b) (i) Hydrogen/H bonds 1

(ii)



Correct atoms **(1)**
Angle 180° /N-H ··· N in straight line **(1)** 2

(c) First line – soluble, insoluble, insoluble **(1)**
Second line – soluble, soluble, insoluble **(1)** 2

(d) (i) **white** fumes/smoke 1

(ii) $NH_3 + HCl \rightarrow NH_4^{(+)}Cl^{(-)}$ 1

[8]

5. (a) *Answers should focus on the information in the 2nd sentence.*

Increased leisure time/holidays
Cheap travel (both needed) 1

(b) Photoageing/premature ageing **(1)**
Skin cancer **(1)** 2

(c) (i) Breaking of a bond when both electrons go to the same atom
OR
Forming two oppositely charged ions – *can be shown by an example* 1

(ii) An entity/species with an **unpaired electron/uneven number of electrons / odd number of electrons** 1

(iii) A chemical which increases the oxidation number/positive charge/ removes the electron(s)/adds oxygen/removes hydrogen from something else 1

(d) up to 105 words: no penalty
106–115 words: –1
116–125 words: –2
126–135 words: –3
and at a rate of –1 penalty for every 5 words excess thereafter, up to a maximum penalty equal to the number of key points included in the answer.

Note that words appearing in the title to the summary do not count in the word total. Normally hyphenated words, numbers, chemical formulae and the abbreviations UVR, UVA and UVB count as one word. 70 % counts as two words.

Marking for key points
To gain the mark for a key point the wording used by the candidate must make clear the essential chemistry of the point.

Key points

1 Avoiding going out in the **sun** /limit **sun** exposure **(1)**

2 But is **socially unacceptable and impractical (1)**

3 **Opaque** /non-transparent etc clothing /"not flimsy and not see through" **(1)**

4 Clothing is effective, providing it is dry/not wet **(1)**

5 Broad/wide-**brimmed**/large hats
OR
hats do not stop reflected light **(1)**

6 Suncreams/preparations which **reflect** the suns rays are effective/reflect UVR **(1)**

7 But need **fine particles** of **titanium dioxide** to **limit reflection** of **visible light** to make them cosmetically acceptable.

8 ...Filter preparations/suncreams **filter**/**absorb ultraviolet radiation**/UVA and UVB/UVR **(1)**

9 but may not absorb all wavelengths/frequencies/ harmful radiations/UVR. **(1)**

Mark to a maximum of 7 marks

Quality of Written Communication

Candidates are expected to:

- show clarity of expression;
- construct and present coherent argument;
- demonstrate effective use of grammar punctuation and spelling.

The aspects to be considered are:

- use of technical terms; the answer should convey a correct understanding by the writer of the technical terms used in the passage which are involved in the key points.
- articulate expression; the answer should be well-organised in clear, concise English, without ambiguity. It should read fluently, with the links between key points in the original maintained.
- legible handwriting; the reader should be able to read the answer without difficulty at normal reading pace, with only the occasional dificulty with a word.
- points must be in a logical order.

Good style and use of English, with only infrequent minor faults, no use of formulae **(2)**
Frequent minor or a few major faults in style and use of English **(1)**
Very poor style and use of English **(0)**

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