3(a)(i)	0.95 (no units) **;** **;**
3(a)(ii)	*any **two** from:* **1** **B**, run for less time / stopped early **;** **2** chlorophyll, converted / changed, to phaeophytin **;** **3** AVP **;**
3(a)(iii)	*any **one** from*: **1** different solvents **;** **2** different, TLC plate / chromatogram / stationary phase (material) **;** **3** different temperatures **;**
3(b)	*any **four** from*: *similarities* **1** both absorb, blue / between 400 and 475 nm **;** **2** both absorb, little / no, light between 525 and, 600 / 630, nm **or** both absorb, little / no, green / yellow, light **;** **3** AVP **;** *max three differences* **4** chlorophyll *a* absorbs, at more / a larger range of, wavelengths **;** **5** chlorophyll *a* absorbs, more / better, between 400 and 445 nm **;** **6** carotenoids absorb, more / better, between 445 and 525 nm **;** **7** chlorophyll *a* absorbs between, 600 / 640, and, 680 / 690 nm, <u>and</u> carotenoids do not **;** **8** chlorophyll *a* (blue absorption) peak / highest, at 425 / 430 nm <u>and</u> carotenoids (blue absorption) peak / highest, at 460 / 465 nm **;** **9** chlorophyll *a* has blue peak and red peak but carotenoids have two blue peaks and no red peak **or** chlorophyll *a* has two peaks but carotenoids have three peaks **;**
3(c)	*any **four** from*: **1** gibberellin, moves to / acts on / stimulates, <u>aleurone</u> layer **;** **2** binds to, (gibberellin) receptor / GID(1) **;** **3** breaks down <u>DELLA</u> (protein) **;** **4** releases, PIF / transcription factor **;** **5** switches on <u>gene</u> for, amylase / maltase / protease **;** **6** amylase, breaks down / hydrolyses, starch to maltose **;** **7** sugars / glucose, for, respiration / growth, of embryo **;**

10(a) *any **three** from:*

	cyclic		non-cyclic	
1	photosystem I (only)	vs	photosystems I <u>and</u> II	;
2	electrons return to, same photosystem / PSI / P700	vs	electrons do not return to same photosystem	;
3	ATP made	vs	ATP and reduced NADP made	;
4	no photolysis	vs	photolysis	;
5	no oxygen produced	vs	oxygen produced	;

10(b)
1 carbon dioxide ;
2 Rubisco ;
3 NADPH ;
4 glucose / hexose / starch / cellulose / glycerol / fatty acids / lipids / amino acids / proteins ;

4(a) *any **three** from:*
(both processes)
1 use / require, carbon dioxide / CO_2 ;
2 use / require, water / H_2O ;
3 use / require, (sun) light energy / source of energy is light ;
4 make an organic, molecule / product ;
5 produce / release, oxygen / O_2 ;
6 involve <u>transduc</u>tion of energy (from one form to another) ;
7 involve electron flow ;

4(b)
A starch, grain / granule ;
B thylakoid (membrane) / lamella / granum ;

4(c)(i) ATP <u>and</u> reduced NADP (and oxygen) ;

4(c)(ii) *any **four** from:*
1 electron carriers / electron transport chain / to carry electrons ;
2 to release energy to, move / pump, protons (into, thylakoid space / lumen)
or
to release energy to generate proton gradient ;
3 oxygen-evolving, complex / enzyme ;
4 (to catalyse) splitting / photolysis, of water ;
5 LHC / antenna complex / photosystem, <u>proteins</u> hold pigments ;
6 ATP synth(et)ase to make ATP ;

4(d) triose phosphate ;

4(e)	*any **two plus one** opposing arguments based on correct ref. to:* **1** percentage / amount, of sunlight, absorbed / used **;** **2** absorption / action, spectrum **or** wavelengths / colours of light, used **;** **3** respiration of organism **;** **4, 5** stage/transition, where, energy lost **; ;** **6, 7** (named) limiting factor(s) **; ;** **8** energy storage capability **or** night / dark, process **;** **9** quality / nutrition in / palatability, of food product **;** **10** proportion edible **;** **11,12** additional energy inputs **; ;** **13, 14** additional resources needed **; ;** **15** labour / maintenance, needed **;** **16** amount of space needed **;** **17** plant, hormones / coordination **;** **18** evolutionary adaptation **;**

8	*any **six** from:* **1** gibberellin binds to (gibberellin) receptor (-enzyme-complex) **;** **2** DELLA (protein) destroyed **;** **3** transcription factor / PIF, released / free / no longer bound to DELLA **;** **4** transcription factor / PIF / RNA polymerase, binds to, DNA / promoter **;** **5** growth / expansion / XET / xyloglucan endotransglucosylase, gene, switched on / expressed / transcribed **;** **6** loosens cell walls / breaks bonds between cellulose **;** **7** water enters (cells) by osmosis causing cell elongation **;** **8** AVP **;**