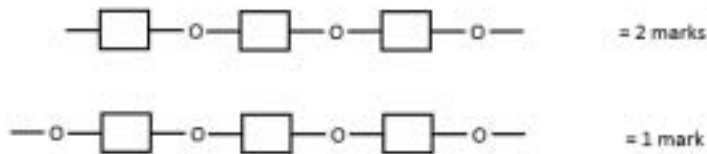


- 1 (a) addition: polymer is the only product / only one product; [1]
condensation: polymer and water formed / small molecule formed; [1]
- (b) Any two from:
ingestion can be fatal to animals / owtte;
animals can be caught in plastics e.g. fishing line / owtte;
combustion releases toxins / owtte;
land-fill uses natural resources / owtte;
allow: any appropriate example [2]
- (c) $\text{CH}_2=\text{CHOCOCH}_3$ [1]
note: double bond does not need to be shown
- (d) $-\text{OC}(\text{CH}_2)_4\text{CONH}(\text{CH}_2)_6\text{NH}-$ [1]
amide linkage correct; [1]
correct repeat units; [1]
continuation bonds shown; [1]

Question	Answer	Marks
2(a)(i)	any two from: <ul style="list-style-type: none"> • shortage of sites / landfill sites fill up; • visual pollution / litter; • danger to wild life; 	2
(a)(ii)	(produce) toxic gases or CO or HCl or HF / carbon dioxide / greenhouse gases;	1
(b)	any two from: bags / clothing or specified clothing / packaging / bowls / cups / plates / flooring / carpets / pipes / insulation / non-stick coatings / ropes;	1

Question	Answer	Marks
(c)(i)	$\text{CH}_2=\text{CHCH}_3$ double bond is shown; rest of structure correct;	2
(c)(ii)		1
(c)(iii)	(car acid; alcohol;	1 1
(d)	addition – polymer only product / only one product; condensation – (polymer and) simple molecule / water / hydrogen chloride made; polymer A is an addition polymer and polymer B is a condensation polymer;	1 1 1

- 3 (a) (i) M1 Contain carbon, hydrogen and oxygen (only) [1]
 M2 hydrogen and oxygen is in a 2:1 ratio (or in the same ratio as water) [1]
- (ii) M1 -O- linkage [1]
 M2 3 monomer units with 3 blocks and 3 Oxygen atoms **Cond** [1]



- (b) catalyst [1]
 biological or protein [1]

- (c) (i) C A B [2]

ABC = 1 ACB = 1 BCA = 1 CBA = 1 BAC = 0
 Allow 70 for C, 40 for B and 20 for A

- (ii) M1 Energy mark: at higher temperature particles/molecules more have more energy or move faster [1]
 M2 Collision frequency mark: collide more frequently/often **or** more collisions per unit time **or** higher rate of collisions. [1]
 Ignore: 'more collisions'
 M3 Collision energy mark: more molecules have enough energy to react or more collisions are above activation energy or successful [1]
- (iii) C rate zero or enzymes denatured [1]

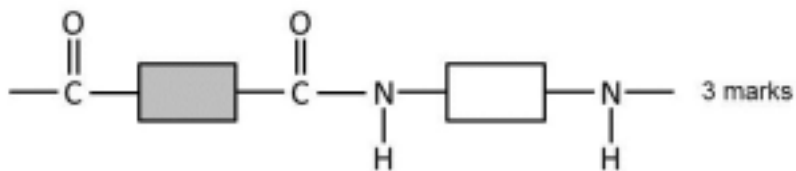
[Total: 12]

4 (a) (i) $\text{CH}_3\text{-CH=CH-CH}_3$ (1)

(ii) one correct amide linkage between two rectangles (1)

correct sequencing of a second amide link and monomers (1)

two correct amide links **and** rest of structure correct (including additional monomers if seen) **and** correct continuation bonds (1) [3]



(iii) protein **or** polypeptide **or** named protein (1) [1]

(iv) addition: **only** the polymer **or** one product is formed (1)

condensation: the polymer **and** a small molecule/water/HCl is formed (1) [2]

(b) (i) does not break down **or** rot **or** decompose (1)

by microbes **or** fungi **or** bacteria **or** by living organisms (1) [2]

(ii) Any **three** from:
visual pollution (1)

(shortage of) landfill sites (1)

danger to wildlife/ animals (including at sea) (1)

toxic gases when burnt **or** greenhouse gases produced when burned (1)

(c) Any **two** from: [2]

resistant to corrosion/unreactive to water/more durable (1)

lighter/less dense (1)

easier to manufacture/can be moulded (1)

good insulator/keeps the water cold (1)

[Total: 14]

- 5 (a) (i) does not de or non-biodegradable or flexible or bendable
or easily moulded or low density / light / lightweight or waterproof / insoluble in water or
does not corrode or durable [1]
- (ii) any two from: [2]
chlorine
hydrogen chloride
carbon monoxide
- (b) $\text{CH}_3\text{—CH} = \text{CH}_2$ [1]
note: can be fully or semi-displayed, C = C must be shown
- (ii) correct repeat unit [1]
 $\text{—CH(C}_6\text{H}_5\text{)—CH}_2\text{—}$
continuation shown [1]
- (c) glucose two products (polymer and water) / condensation (polymerisation) / (small)
molecules removed [1]
phenylethene one product (polymer) / addition (polymerisation) [1]
- 6 (a) protective / layer **and** of oxide [1]
- (b) correct repeat unit [1]
continuation shown [1]
- (c) catalyst [1]
biological / protein [1]
- (ii) hydrochloric acid / any strong acid / any strong alkali [1]
- (iii) amino acids [1]
- (iv) chromatography [1]
- (v) nylon / kevlar [1]
- (d) (non-biodegradable
- (ii) $\text{CH}_2=\text{CH(C}_6\text{H}_5\text{)}$ [1]

[Total: 11]

7 (a) **burning**

produces toxic gases / harmful to health
increases greenhouse gases / global warming
reduces visual pollution / litter
reduces risks to wildlife
shortage of landfill sites / reduces space needed in landfill sites / saves space
non-biodegradable / long time to rot / decompose / accumulates waste
burning source of energy / used to generate electricity

recycling

conserves petroleum / natural resources
difficult to recycle / expensive / takes much energy
problems over sorting
reduces need for landfill
quality of plastic is reduced each time it is recycled
four DIFFERENT valid points which are advantages or disadvantages of burning and/or recycling

[4]

(b) (i) addition (polymerisation);

[1]

(polymer) only product / no by-products;

[1]

condensation (polymerisation);

[1]

(polymer and) simple molecule / water / hydrogen chloride / one other product forms; [1]

(ii) a correct linkage (for a polyamide / polyester);

[1]

two different monomers;

[1]

[Total: 10]