AS 11 **DIET AND DIGESTION**

ANSWERS & MARK SCHEMES

QUESTIONSHEET 1

(a) A - liver;
B - stomach;
C - colon/descending colon/large intestine; **3**

(b) (i) absorption;
of products of digestion/salts/vitamins; **2**

(ii) Any two of: long/many villi to increase surface area/microvilli to increase surface area/dense capillary network/ presence of lacteals;; **2**

(c) Any two of: saliva/pancreatic juice/intestinal juice;; **2**

(d) (i) small intestine/ileum;
(ii) stomach;
(iii) large intestine/colon; **3**

TOTAL 12

QUESTIONSHEET 2

(a) A - villus;
B - circular muscle;
C - longitudinal muscle;
D - crypt (of Lieberkühn); **4**

(b) (i) shape increases surface area/large surface area;
microvilli increase surface area;
many capillaries to absorb into blood/good blood supply;
lacteals to absorb into lymph;
surface epithelium only one cell thick; **max 4**

(ii) Any four of: peptidase/exopeptidase/endopeptidase/carboxypeptidase/aminopeptidase/ to digest polypeptides to amino acids/
maltase to digest maltose to glucose/
lactase to digest lactose to glucose and galactose/
sucrase to digest sucrose to glucose and fructose/
lipase to digest fats to fatty acids and glycerol;;;; **4**

TOTAL 12

QUESTIONSHEET 3

(a) 37^{o}C;
because this is the temperature at which saliva normally acts/
enzymes denature at high temperatures/at temperatures over 45°C; **2**

(b) body fluids/tissue fluid/plasma/lymph; **1**

(c) starch molecules are too big; **1**

(d) glucose/maltose/reducing sugar; **1**

(e) mix equal volumes of solution and Benedict Reagent;
boil in waterbath;
brick red precipitate implies glucose/maltose/reducing sugar is present; **3**

TOTAL 8

QUESTIONSHEET 4

(a) A - epithelium;
B - longitudinal muscle;
C - circular muscle; } allow 1 mark for 'muscle' unqualified.
D - lumen; **4**

(b) (i) duodenum/ileum;
(ii) stomach;
(iii) ileum/small intestine;
(iv) duodenum; **4**

(c) stratified squamous epithelium;
thick and keratinised/contains keratin;
to withstand friction/abrasion of passing food; **3**

TOTAL 11

QUESTIONSHEET 5

(a)

Stimulus	food/taste/smell of food ;
Receptor	taste buds ;
Effector	salivary glands ;

3

(b) (i) reflex; **1**

(ii) gastrin; **1**

(iii) nervous system acts faster (than hormones);
but hormonal effects last longer; **2**

(c) nervous system can stimulate immediate production of gastric juice;
hormonal control means flow can continue for some time after meal has been eaten;
therefore digestion begins as soon as possible and continues for as long as food is in the stomach; **3**

TOTAL 10

QUESTIONSHEET 6

(a) there is a marked increase in the secretion/volume/concentration of hydrogen carbonate ions of pancreatic juice;
at 20 mins; **2**

(b) on a separate occasion the same person/animal;
could be injected with a similar solution minus the secretin;
this would show whether the effect is due to the presence of secretin only; **3**

(c) 0 mins: $0.3 \times 17 = 5.1$ (iu);
20 mins: $17.7 \times 3 = 53.1$ (iu); **2**

(d) increases volume of pancreatic juice secreted;
increases concentration hydrogen carbonate ions;
increases amylase secretion (but effect masked by large volume increase); **3**

TOTAL 10

QUESTIONSHEET 7

(a) (i) contains all the (necessary) dietary components;
in the correct proportions to maintain health;
carbohydrates + proteins + lipids + salts + vitamins (+ water); **3**

(ii) ageing; energy requirements fall so reduce carbohydrate/fat; **2**
pregnancy; need extra calcium/iron to make fetal bone/blood; **2**
lactation; Need extra sugar/fat/calcium to make milk; **2**
(Could also give, sickness, growing, changing to more active job)

(b) (i) non-essential amino acids can be made by the body and so need not be in the diet;
essential amino acids cannot be made in the body and so must be in the diet; **2**

(ii) reduces absorption of sugars/fats (from gut);
so helps to control weight;
enables easy formation of faeces/easy defaecation/contributes to bulk of faeces;
reduces incidence of bowel disease/diverticulosis/ulcerative colitis/constipation/cancer of the colon; **max 3**

TOTAL 14

QUESTIONSHEET 8

(a) (i) 1. 2.0;
2. 9.0 (accept in range 8.5 -9.5) **2**

(ii) 1. - pepsin;
2. - trypsin; **2**

(iii) pepsin works best in acidic/low pH;
trypsin works best in alkaline/high pH; **2**

(b) (i) Any two of: provides optimum pH for stomach enzymes/disinfection/activates pepsinogen to pepsin/
aids iron absorption;; **2**

(ii) Any two of: provides alkaline pH for duodenal enzymes/neutralises stomach acid/
saponification/alkaline hydolysis of fats;; **2**

TOTAL 10

QUESTIONSHEET 9

(a) peanut temp rise = 78^0C } ; $4.18 \times 20 \times 78 =$ } ; 6521 Joules;
bread temp rise = 21^0C } ; $4.18 \times 20 \times 21 =$ } ; 1756 Joules; **4**

(c) peanut;
contains much fat and oil whereas bread contains starch;
fat and oil have greater energy content (than starch); **3**

(c) oil/fat/lipid; **1**

(d) carbon; **1**

(e) some heat from flame is lost and doesn't heat the water;
food may not be completely burnt/different water contents in food to begin with; **2**

TOTAL 11

QUESTIONSHEET 10

(a) oesophagus; peristalsis; cardiac sphincter; hydrochloric acid; pepsin; chyme; pyloric sphincter; secretin; pancreozymin; emulsify; trypsinogen; enterokinase; protein; blood/villi; hepatic portal; **15**

(b) (i) Any three of: glucose/sugars/amino acids/minerals/vitamins/water ;;; **3**

(ii) fat/fatty acids and glycerol; **1**

(c) the utilisation by the body of the absorbed foods;
as respiratory substrate/for ATP production;
or for protein/enzyme/hormone synthesis; **3**

TOTAL 22

QUESTIONSHEET 11

(a) (i) diet/any correct food/margarine/liver/eggs/butter;
ref to fish liver oils (as dietary supplement);
manufactured/activated in the skin during sunlight; **max 2**

(ii) failure of bones to harden/ossify/softening of bones;
bow legs/knock knees/bent long bones;
teeth fail to harden properly; **max 2**

(iii) clean air act/smokeless zones (so that children receive more sunlight);
fortification of margarine/foods with vitamin D;
use of cod/fish liver oil as dietary supplement; **max 2**

(iv) to pass to the baby for healthy bone growth/need to supply mother and baby with adequate quantities;
ref to across the placenta/via milk; **max 2**

(b) (i) weight of carotene to be ingested = 750 x 6 = 4500 µg;
∴ weight of carrots to be eaten $= \frac{4,500}{12,000} \times 100$;
= 37.5 g; **3**

(ii) night blindness/failure to manufacture rhodopsin;
xerophthalmia/keratinised/opaque cornea;
dry scaly epithelial surfaces/more prone to infection; **max 2**

(iii) liver/butter/cheese/eggs/fish liver oils; **1**

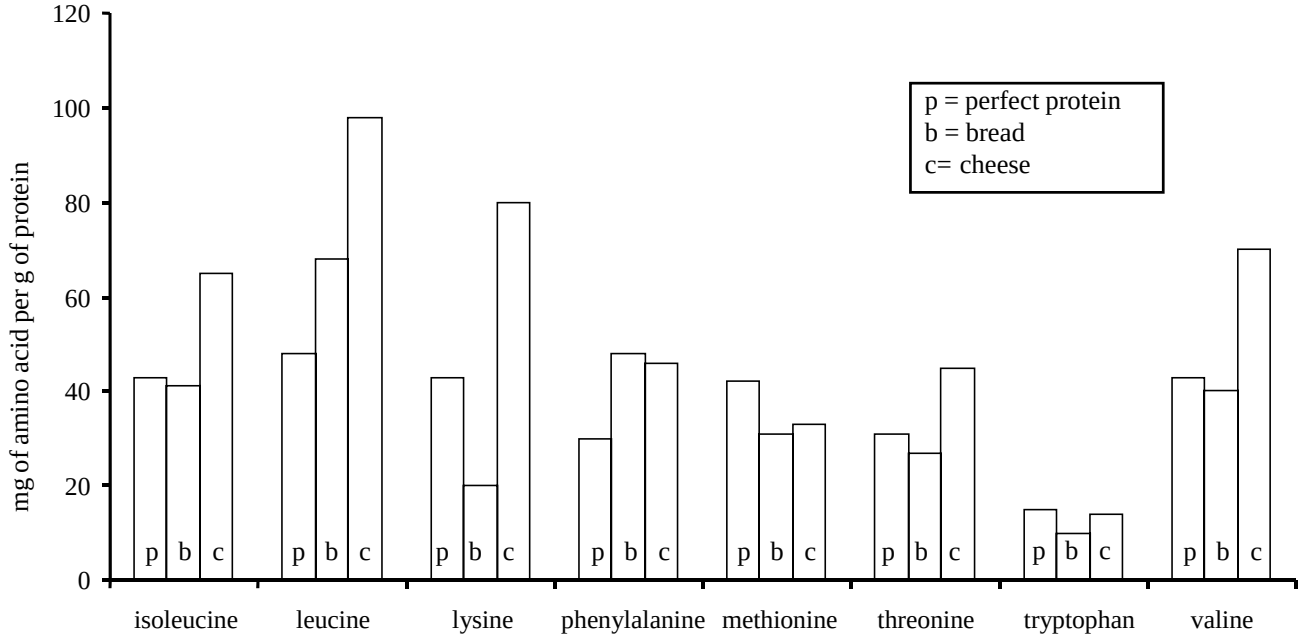
(iv) ref fortification/it is added to margarine by the manufacturer; **1**

TOTAL 15

QUESTIONSHEET 12

(a) essential amino acids cannot be made by the body and so must be in the diet;
non-essential amino acids can be made in the body and so need not be in the diet; 2

(b) (i) labelled axes; suitable scale; correct plotting; key/blocks labelled; **4**



(ii) cheese is deficient in tryptophan/methionine;
but is a good source of the other essential amino acids/named example; **2**

bread is deficient in lysine/tryptophan/methionine/threonine;
but is a good source of other esential amino acids/named examples; **2**

when eaten together the deficiencies of one are complemented/made up by the other/becomes equivalent to perfect protein;
for example, lysine deficiency in bread is compensated by its high content in cheese; **2**

(iii) some foods do not contain all the dietary requirements ;
or have inadequate quantities of some requirements;
thus to obtain all requirements in the correct quantities many different foods must be eaten; **max 2**

(c) kwashiorkor; **1**

TOTAL 15

QUESTIONSHEET 13

(a) (i) (mutualism is the) close association between 2 living organisms;
of different species;
which is beneficial to both;
eg. ruminants and cellulose digesting bacteria/Rhizobium and clover/alga and fungus in lichens; **max 3**

(ii) (parasitism is a) close association between 2 living organisms of different species;
to the benefit of the parasiite;
causes damage/disadvantage to the host;
eg. sheep and liver fluke/pig and tapeworm/dog and flea; **max 3**

(b) saprophytes;
fungi;
Mucor/Penicillium/other e.g;
enzymes/accept named correct enzymes;
extracellular;
absorbed; **6**

TOTAL 12

QUESTIONSHEET 14

(a) mode of nutrition is basically autotrophic/photosynthesis;
tend to live in nitrogen deficient habits so have evolved to capture (and digest) insects;
lure the insects with bright colour/sweet nectar/scent;
secrete proteases onto the insects/digest proteins to amino acids;
absorb the amino acids directly into the plant tissues for assimilation; **max 4**

(b) ruminants eat grass and so have a problem digesting cellulose;
chew the cud to break down the cell walls (by extra mastication);
have cellulose digesting bacteria/fungi in the rumen;
these break cellulose down to acetic/ proprionic/ butyric acids;
products/these are absorbed (by the blood) and used in metabolism; **max 4**

(c) feed on dead organic matter/extracellular digestion;
ref to saprophytic mode of nutrition;
secrete enzymes into substrate to digest food content;
proteases, carbohydrases and lipases;
products of digestion absorbed into hyphae for assimilation; **max 4**

TOTAL 12

QUESTIONSHEET 15

(a) organic substances required in minute quantities;
lack of vitamin produces specific (deficiency) symptoms/diseases; **2**

(b) (i) Vitamin C
Source: Fruits/fresh vegetables;
Function: maintenance of healthy skin/connective tissue/capillary walls/prevention of excess bleeding; **2**

(ii) Vitamin A
Source: carrots/fresh vegetables/butter/margerine/liver/cheese/eggs/fish liver oils;
Function: manufacture of rhodopsin/visual purple/maintenance of healthy epithelia; **2**

(iii) Vitamin D
Source: fish liver oils; egg yolk; manufactured/activated in skin when exposed to sunlight;
Function: stimulates calcium absorption in gut/calcium metabolism; uptake of phosphorus; **2**

(c) kwashiorkor = protein deficiency;
marasmus = protein and energy/carbohydrate deficiency; **2**

TOTAL 10

QUESTIONSHEET 16

(a) Estimated Average/Mean Requirement; **1**

(b) the nutrient intake which equals/exceeds the nutrient needs of most of the population; **1**

(c) obesity/overweight;
leads to an increased risk of, diabetes;
coronary heart disease;
hypertension;
cancer;
arthritis;
stroke; **max 4**

TOTAL 6

QUESTIONSHEET 17

(a) the energy needed to maintain vital functions/essential metabolism/metabolism at rest;
e.g. blood circulation/temperature control/ventilation; **2**

(b) (i) males have greater proportion of muscle;
muscle metabolically very active;
males have less body fat so lose more heat; **max 2**

(ii) too much fat is associated with coronary heart disease/myocardial infarction/obesity/stroke/arthritis;
but some fat intake is needed to supply essential fatty acids/fat soluble vitamins/phospholipids/cholesterol; **2**

(c) Any four of:
increased maternal requirement for carbohydrate for energy/
(increased) protein for tissue growth of fetus/
minerals/Ca/Mg/Fe/for fetus/fetal bone growth/blood formation/
folic acid for fetal red cell formation/
vitamin A/C/D;;;; **4**

TOTAL 10

QUESTIONSHEET 18

(a) A: fat/triglyceride;
Product: fatty acids and glycerol;
Enzymes: pancreatic/intestinal; lipase; **4**

B: dipeptide;
Product: amino acids;
Enzymes: exo/endo/carboxy/amino; peptidase; **4**

C: maltose/disaccharide;
Product: monosaccharides/glucose;
Enzyme: maltase; **3**

(b) obsession about weight loss/dieting/exercise;
psychological disorder;
muscle wasting;
loss of body fat;
low blood pressure;
disturbed menstrual cycle; **max 4**

TOTAL 15

QUESTIONSHEET 19

(a) (one that) contains all required nutrients in correct proportions;
carbohydrate/protein/fat/vitamins/inorganic ions/water; **2**

(b) (i) A $\frac{105}{(1.8)^2} = \frac{105}{3.24}$; = 32.4 ;

B $\frac{70}{(1.64)^2} = \frac{70}{2.69}$; = 26.0 ;

4

(ii) individual A;
has higher BMI/falls in 'clinically obese' range; **2**

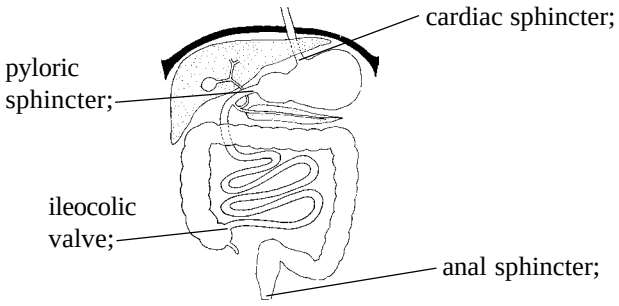
(c) graph does not support the suggestion;
obese individuals have higher metabolic rates/greater rate of energy use than thin individuals;
if they had a 'super efficient' metabolism their metabolic rates would be lower than thin individuals; **max 2**

TOTAL 10

QUESTIONSHEET 20

(a) (i) 1. salivary glands/pancreas;
2. liver/gall bladder;
3. salivary glands/stomach/small intestine/large intestine/colon;
4. stomach; **4**

(ii)



4

(b) adds bulk to faeces/makes it easier to form faeces;
increases speed of movement of material through digestive system;
helps protect against cancers/ulcerative colitis/diverticulosis;
reduces fat absorption/binds up enzymes after use; **max 3**

TOTAL 11

QUESTIONSHEET 21

(a) an organism which obtains its energy/food/nutrients from another living organism/host;
without (necessarily) killing the organism/host;
lives in/on the host organism; **3**

(b) flattening gives large surface area for food absorption/ref to thin segments/proglottids;
hooks to attach to gut (wall) of host;
suckers to attach to gut (wall) of host; **max 2**

(c) (i) ref to hospitable environment;
nutrients obtained in convenient form/ready digested form;
ref to advantage of locomotory ability of host; **3**

(ii) difficult to spread to new hosts/for eggs/offspring to reach new hosts; **1**

TOTAL 9

QUESTIONSHEET 22

(a) (i) A = columnar; epithelium; B = smooth; muscle; C = capillary; D = lacteal; **4**

(ii) large surface area for greater absorption;
possess microvilli which further increase surface area;
rich supply of blood capillaries to transport absorbed products away;
contains lacteal/lymph duct for fat absorption;
contains smooth muscle/can contract/wave to come into contact with products; **max 3**

(The question uses the verb 'explain'. Thus the points should be qualified with the explanations in order to score.)

(b) (i) salivary amylase/pancreatic amylase digests starch/glycogen;
to maltose;
maltose digested by maltase to glucose;
sucrose digested by sucrase to glucose and fructose;
lactose digested by lactase to glucose and galactose;
lactase/maltase/sucrase are in intestinal juice/succus entericus; **max 4**

(ii) glucose/galactose/fructose absorbed in ileum/small intestine;
fructose absorbed by facilitated diffusion;
glucose/galactose actively absorbed;
in combination with sodium ions/ref carrier protein needs glucose + galactose + Na^+ to work; **max 3**

TOTAL 16

QUESTIONSHEET 23

(a) breakdown of large/complex insoluble substances;
by hydrolysis;
into small/simple soluble ones;
involves enzymes; **max 2**

(b) surface area of mucusa increased by folds/ridges/rugae;
surface area (also) increased by having thousands of /many villi;
villi have good blood supply;
lacteals for fat absorption;
individual epithelial cells possess brush border/microvilli (to increase surface area for absorption); **max 3**

(c) saprophytic;
feed on dead organisms/waste products/organic matter (in soil);
secrete extracellular enzymes;
amylases for digestion of carbohydrates/lipases for digestion of fats;
absorb products of digestion/sugars/fatty acids/glycerol; **max 3**

TOTAL 8