# Option D

**1a.** *[1 mark]*

State which country has the lowest total percentage of overweight and obese adults.

## Markscheme

Indonesia

 **1b.** *[2 marks]*

Distinguish between the levels of male obesity and female obesity.

## Markscheme

a. higher percentage of obese females (compared to males);

b. greatest difference is in Morocco/Brazil;

c. least difference (between obese males and females) is in China/UK;

*Accept numerical distinctions.*

 **1c.** *[2 marks]*

Compare the overweight and obesity patterns in Australia and Morocco.

## Markscheme

a. higher total percentage of overweight/obese in Australia (compared to Morocco);

b. Australia has more overweight/obese males than females and Morocco has more overweight/obese females than males / *vice versa*;

c. less difference between male and female obesity in Australia than Morocco / *vice versa*;

d. more overweight than obese in both Australia and Morocco;

 **1d.** *[2 marks]*

Suggest **two** possible reasons for the differences in BMI from the reported countries.

## Markscheme

a. different availability/poverty/costs of inexpensive high-energy/high fat/high sugar foods;

b. portion sizes / availability of away-from-home food/fast food;

c. different levels of activity / sedentary lifestyle;

d. cultural differences;

e. nutritional education;

f. genetic/inherited differences;

 **2.** *[1 mark]*

List **two** natural food sources of vitamin D in human diets.

## Markscheme

*Award* ***[1]*** *for any two natural food sources.*

fatty fish / salmon/tuna/mackerel/sardines/fish oils;

egg / egg yolks;

liver;

mushrooms;

cheese/milk/butter/yogurt/other dairy product;

*Do not accept supplemented foods or "fish" alone.*

 **3a.** *[1 mark]*

State the risk of a man developing CHD between the ages of 55–59 if his brother had CHD.

## Markscheme

35 %

 **3b.** *[1 mark]*

Calculate the increase in risk over the control group for a woman of 60–64 of developing CHD if her sister had the disease.

## Markscheme

15 %

 **3c.** *[3 marks]*

Compare the results for the men and the women.

## Markscheme

a. both show an increase in the risk of CHD as age increases;

b. men/women with (either) siblings with CHD show an increased risk (relative to their control);

c. men have greater risk than women of developing CHD (at all ages);

d. both men and women/women only are more likely to develop CHD if their sister has the disease;

e. men with a brother with CHD have a greater risk than women with a brother with CHD;

*Accept any other valid comparison using the graph.*

 **3d.** *[2 marks]*

Suggest **two** reasons why a man is more likely to develop CHD if his brother had the disease.

## Markscheme

a. hereditary/genetic predisposition;

b. similar (unhealthy) lifestyles/diets;

 **4a.** *[1 mark]*

Water and minerals are essential in the human diet. List two other types of nutrient in a human diet.

1: . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .2: . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

## Markscheme

(essential) amino acids;(essential) fatty acids / oils / lipids / fats;vitamins;carbohydrates;

 **4b.** *[2 marks]*

Outline the benefits of using iodine as a dietary supplement.

## Markscheme

a. iodine is a mineral that is often scarce in local diets/water supplies;b.required for normal thyroid function/synthesise thyroxine;c.prevents goitre/avoid iodine deficiency/avoid absorbing iodine–131/radioactiveiodine;d.prevents brain damage;[

 **5a.** *[1 mark]*

Identify the substance that varies the most in the plasma of the mothers.

## Markscheme

urea

 **5b.** *[1 mark]*

Calculate the difference between birth mass of offspring whose mothers were fed the AP diet and the HP diet.

. . . . . . . . . . . . . . . . . . . . . kg

## Markscheme

0.20 (kg) (less weight in HP)

 **5c.** *[1 mark]*

Distinguish between LDL cholesterol and HDL cholesterol in relation to the diet.

## Markscheme

LDL cholesterol increases and HDL cholesterol decreases as (proportion of) protein increases/carbohydrate decreases / *OWTTE*.

 **5d.** *[2 marks]*

Explain the low birth mass of offspring born to mothers who were fed the LP diet.

## Markscheme

a. lack of essential amino acids to form protein;b. not enough protein for growth;c. not enough amino acids/protein to form muscle/tissues;d. low protein may affect production of enzymes;

 **5e.** *[3 marks]*

In many societies doctors may recommend an HP diet for pregnant humans. Using the data, evaluate this recommendation.

## Markscheme

*(the data does not support the recommendation):*a. as HP has the highest level of plasma urea which could be toxic;b. HP has a high level of LDL/bad cholesterol and a low level of HDL/good cholesterol which could lead to coronary heart disease;(accept high ratio of LDL: HDL)c. HP produces a high level of glucose (compared to AP) which could lead to diabetes;d. HP produces a low birth weight (compared to AP) which may affect development / OWTTE;

*(the data does support the recommendation):*e. the mother has a similar weight gain to AP thus avoiding health problems;

 **6a.** *[2 marks]*

State two symptoms of type II diabetes.

## Markscheme

a. glucose in urine;b. high blood glucose;c. frequent urination / dehydration/excess thirst;d. constant hunger;e. weight loss;f. tiredness;

 **6b.** *[4 marks]*

Explain the causes and consequences of phenylketonuria (PKU).

## Markscheme

a. (point) mutation of gene;b. defective enzyme/phenylalanine hydroxylase (PAH);c. phenylalanine/Phe not broken down to tyrosine/Tyr;d. phenylalanine/Phe accumulates;e. (if not treated) symptoms mental retardation/seizures;f. diet free of phenylalanine/Phe to avoid symptoms;

 **7.** *[2 marks]*

The electron micrograph shows the epithelial cells of the villus.



 Identify the parts labelled I and II.

I: . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . II: . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

## Markscheme

a. *I*: microvilli;b. *II*: tight junction / plasma membrane;

 **8a.** *[1 mark]*

List **two** consequences of anorexia nervosa.

1.

2.

## Markscheme

*Award* ***[1]*** *for any two consequences.*

weight loss;

anemia;

depression/anxiety disorders;

abdominal distension;

hair loss/thinning;

flaky skin;

cessation of menstrual cycle / other hormonal imbalance;

death;

 **8b.** *[3 marks]*

Explain the causes, consequences and treatment of phenylketonuria (PKU).

## Markscheme

*causes*: genetic/inherited (homozygous recessive) disorder / mutation in (gene for) enzyme that converts phenylalanine into tyrosine / lack of phenylalanine hydrolase/PAH;

*consequences*: phenylalanine converted to phenylketone / mental retardation / brain damage / seizures;

*treatment*: low-phenylalanine diet / example of substances that cannot be eaten;

*(eg any food containing protein / aspartame)*

 **9a.** *[3 marks]*

Outline the molecular structure of different types of fatty acids.

## Markscheme

fatty acids share a common structure but differ in the total number of carbon atoms in the chain;

saturated fatty acids have no double bonds between carbon atoms;

unsaturated have double bond(s);

monounsaturated have one double bond / polyunsaturated have more than one double bond;

*cis* fatty acids have adjacent hydrogen atoms on same side of double bond and *trans* have them on opposite side;

*(accept annotated diagrams)*

 **9b.** *[3 marks]*

Evaluate the benefit of reducing cholesterol in the diet.

## Markscheme

cholesterol is a steroid found mainly in animal products;

it builds up in the walls of arteries / causes clogging/narrowing/blockage of artery / atherosclerosis;

lowering its ingestion may lower the probability/ risk of coronary heart disease/CHD;

cholesterol can be synthesized by the liver;

factors other than diet can affect levels of cholesterol / genetic factor more important than diet;

 **10a.** *[2 marks]*

State the concentration of cholesterol in liver tissue and the mass of bile salts in feces for the normal diet, giving the units.

Concentration of cholesterol:

Mass of bile salts:

## Markscheme

*concentration of cholesterol:* ;

*(accept answer in the range of 10.5 mg**g to 11.5 mg**g*)

*mass of bile salts: 12 mg**day*;

*(accept answers in the range of 11.5 mg**day* *to 12.5 mg**day*)

*Units are required.*

 **10b.** *[1 mark]*

Calculate the percentage increase in the concentration of cholesterol in liver tissue, caused by feeding the rats a high cholesterol diet without supplementing with bacteria. Show your workings.

## Markscheme

 *(accept answers in the range of 72.7(%) to 81.0(%))*

 **10c.** *[2 marks]*

Deduce the effects of supplementing the diet with *Lactobacillus* on the concentration of cholesterol in liver tissue and on the mass of bile salts in feces.

## Markscheme

supplementation decreases liver cholesterol in high cholesterol diet;

not enough to bring it to the level of a normal diet;

no difference between *L. plantarum* and *L. fermentum* in the decrease of liver cholesterol;

supplementation increases bile salts levels;

greater increase in bile salts levels with *L. plantarum* / lesser/(perhaps) non-significant increase with *L. fermentum*;

 **10d.** *[3 marks]*

Scientists hypothesized that *Lactobacillus* could be used in diets to reduce the incidence of coronary heart disease (CHD). Evaluate the evidence for and against this hypothesis provided by the data.

## Markscheme

*Evidence for hypothesis:*

*Lactobacillus*/supplements lower liver cholesterol (in high cholesterol diet) which is a risk factor for CHD;

*Lactobacillus*/supplements increase bile salts in feces which implies some cholesterol may be eliminated;

*Evidence against hypothesis:*

not known if cholesterol ends up in blood instead thus increasing risk for CHD;

no data about benefit for normal diet/actual decrease of incidence of CHD;

data/results based on rat experiments / may not apply to humans;

WTTE of taking into account difference in bile salt level between *L. fermentum* and *L. plantarum*;

 **11a.** *[1 mark]*

This study also showed a significant reduction in insulin sensitivity when participants were given fructose-sweetened drinks, but not when they were given glucose-sweetened drinks.State the disease that could be caused by excessive consumption of fructose.

## Markscheme

diabetes type II / late/adult-onset diabetes*Do not award mark for type I diabetes.*

 **11b.** *[2 marks]*

Suggest how sugar uptake might be related to pancreatic cancer.

## Markscheme

a. cancer is uncontrolled mitosis/cell division;b. sugar is an energy source/nutrient needed for mitosis/cell division;c. ribose is used to produce nucleic acids/DNA/RNA;d. production of nucleic acid is necessary for mitosis;

 **12a.** *[1 mark]*

Outline the effect of vitamin C intake on changes in bone density in the spine.

## Markscheme

a. high (vitamin C) causes a positive change (in BMD) whereas medium/low causes negative change;b. inversely proportional (for relative change);c. if vitamin C intake increases, BMD increases;

 **12b.** *[2 marks]*

Compare the changes in bone density of the femoral neck with those of the spine.

## Markscheme

a. positive change/reduced loss for femoral neck at all levels whereas only at high intake for spine;b. higher values for femoral neck for each intake category;c. inversely proportional for both;d. no overlap between range/standard deviation / clear distinction of protective effect between femoral neck and spine (for high/all intake categories);

 **12c.** *[2 marks]*

Evaluate the evidence provided by the data that the intake of vitamin C supplements may reduce bone density loss in elderly people.

## Markscheme

*Implications:*a. high intake results in positive value (for all locations);b. protective effect proportional to intake;

*Limitations:*c. proportion of vitamin C intake from supplements / influence of other factors not stated;d. only a few bone locations measured / sample size unknown / high medium and low not defined; *At least one implication and one limitation required.*

 **13a.** *[2 marks]*

Outline the control mechanism for appetite in humans.

## Markscheme

a. appetite control centre (in brain) makes person feel full/satiated/hungry;b. function is both nervous and hormonal;c. after eating (centre) responds to hormones/insulin from pancreas/hormones/PYY from small intestine/hormones from adipose tissue/leptin in response to fat storage;d. centre responds to hormone/ghrelin released from empty stomach;e. part of centre responds to levels of lipid/sugar in the blood;

 **13b.** *[3 marks]*

Explain the possible health consequences of a diet rich in protein.

## Markscheme

a. high amount of one nutrient may cause deficiency in another one;b. excess protein not stored as protein by the body / converted to fat;c. results in weight/mass loss in many people (due to fat/carbohydrate deficiency);d. health problems such as kidney stones/other health problems;e. high protein as part of a weight/mass loss diet;

 **14.** *[2 marks]*

Evaluate the health consequences of a diet rich in polyunsaturated fatty acids.

## Markscheme

a. polyunsaturated fatty acids are preferable to saturated fatty acids;b. decreases risk of cardiovascular disease;c. provide (concentrated) energy / can lead to obesity;

 **15a.** *[1 mark]*

Outline how bile helps in lipid digestion.

## Markscheme

bile emulsifies/*OWTTE* lipids so enzymes can act on them

 **15b.** *[3 marks]*

Describe how bile pigment is formed.

## Markscheme

a. hemoglobin from the red blood cells is absorbed/phagocytosed in the liver/by Kuppfer cells;b. hemoglobin is broken down into heme and globin groups;c. iron is removed from the heme groups;d. (residue from) heme becomes bilirubin/bile pigment (in hepatocytes);

 **16.** *[3 marks]*

Explain **two** pieces of dietary advice that might be given to someone suffering from type II diabetes.

## Markscheme

(dietary recommendations needed) to reduce blood glucose levels as target/ body/muscle cells less sensitive to insulin / not enough insulin produced;reduce intake of (saturated) fats, to reduce weight;reduce the intake of sugar/simple carbohydrates, causes rapid increase in blood glucose concentration;eat more high fibre foods, satisfy appetite, but cannot be broken down;regular/many small meals, to avoid (rapid) rise in glucose after a big meal;eat complex carbohydrates/carbohydrates with a low glycemic index, digested and absorbed more slowly; *To award the mark, answers require recommendation with a reason.*

 **17a.** *[3 marks]*

The table shows the death rate due to coronary heart disease (CHD) in two different countries.



Using the table below, outline **three** **named** factors that could be responsible for the differences between the two populations.



## Markscheme



*Award* ***[1]*** *for a factor and a corresponding outline.*

 **17b.** *[2 marks]*

State **four** glands secreting digestive juices into the alimentary canal.

1. ............................................................. 2. ............................................................. 3. ............................................................. 4. .............................................................

## Markscheme

*Award* ***[1]*** *for two correct glands.*salivary glands;gastric glands;pancreas;wall of the small intestine;

 **18a.** *[3 marks]*

Outline the importance of fibre as a component of a balanced diet.

## Markscheme

fibre/cellulose cannot be digested;aids peristalsis/helps to prevent constipation/adds bulk;prevents obesity by increasing bulk in the stomach;reduces the risk of appendicitis/cancer/hemorrhoids;slows the rate of sugar absorption/helps prevent diabetes;

 **18b.** *[1 mark]*

Distinguish between minerals and vitamins.

## Markscheme

minerals are inorganic elements (simple compounds from elements in ionic form) and vitamins are organic compounds (which cannot be synthesised by the body);minerals are all water soluble but only some vitamins are water soluble (others are lipid soluble);some vitamins are destroyed by exposure to oxygen, minerals are not;

 **19a.** *[2 marks]*

In healthy adults, there are heart sounds during the cardiac cycle. Outline the causes of **two** of these sounds.

## Markscheme

changing pressure of blood in heart automatically opens and closes the valves / the closing of valves generates the heart sounds;first heart sound (S) is produced by the closing of the AV valves/mitral and tricuspid valves;second heart sound (S) produced by the closing of semilunar valves/aortic and pulmonary valves;

 **19b.** *[2 marks]*

State **two** products resulting from the breakdown of erythrocytes (red blood cells) in the liver.

1. ..................................................................

2. ..................................................................

## Markscheme

iron;bile pigments/bilirubin;globin/amino acids;

 **19c.** *[3 marks]*

Compare gastric juice and pancreatic juice.



## Markscheme



*Award* ***[1]*** *for each correct row.*

 **19d.** *[1 mark]*

List **one** material that is egested after human digestion.

## Markscheme

cellulose / lignin / bile pigments / intestinal cells / bacteria

 **20a.** *[1 mark]*

Measure the difference between the percentage of overweight men and the percentage of overweight women at age 20.

## Markscheme

10 (%) (*allow responses in the range of 9 to 11 %*)

 **20b.** *[1 mark]*

State the range of the body mass index (BMI) that corresponds to overweight status.

## Markscheme

25.0 −29.9 / above 25 and below 30 *Do not accept 30 as this is classed as obese.*

 **20c.** *[2 marks]*

Compare the percentage of men and women who exercised daily.

## Markscheme

more women exercise than men;both show an increase (between ages 16 to 25);similar trend lines over time / slightly greater increase in women;women have greater increases and decreases/greater variability while men gradually increase/stays level; *Award any one of the above marking points if shown as a valid numerical comparison.*

 **20d.** *[3 marks]*

Evaluate the hypothesis that being overweight is due to lack of exercise.

## Markscheme

*(*hypothesis is supported) as the greater percentage of men are overweight and they exercise less than women / *vice versa*;(hypothesis is supported) lowest percentages of overweight ages (18 and 20) correspond with peaks of exercise;(hypothesis is not supported) as even though both men and women exercise more over time the percentage overweight also increases;(hypothesis is not supported) other named factor which influences being overweight; (*e.g. availability of cheap high energy foods / large portion sizes / increasing use of vehicles for transport / changes from active to sedentary occupations / genetics*)

BMI does not consider muscle mass/bone structure/bone density;only narrow range of ages considered;

 **21a.** *[1 mark]*

State which listed nutrient does not supply energy.

## Markscheme

fibre

 **21b.** *[2 marks]*

Deduce, with a reason, which listed nutrient provides the most energy per 25 g serving.

## Markscheme

monounsaturated fat;fats contain more energy than carbohydrates or proteins;fats contain 4000 kJ per 100 g/9 kcal per 100 g;more monounsaturated fat present than other fats;

 **21c.** *[3 marks]*

Outline the differences in molecular structure between the types of fat found in the peanuts.

## Markscheme

saturated and unsaturated fats differ in number of single and double carboncarbon bonds/ratio of hydrogen to carbon atoms in fatty acid chains;saturated fat – carbon atoms all joined by single bonds / have no double bonds / have no increase in number of hydrogen atoms possible;monounsaturated fat – one double bond in carbon chain / could add two hydrogens in the carbon chain;polyunsaturated fat – two/more double bonds in the carbon chain;saturated fatty acid chains tend to be straight while mono/polyunsaturated have kinks/bends;

 **22.** *[3 marks]*

Explain the benefits of supplementing common foods with vitamins and minerals.

## Markscheme

supplies essential nutrients lacking in diet / nutrients added by manufacturers;benefits lower socio-economic groups as common foods are consumed by most people / reduces the need to purchase supplements;prevents nutritional deficiencies/deficiency diseases;named example of mineral/vitamin supplementation; (*e.g. iodine in salt*)

 **23a.** *[3 marks]*

Outline factors that can lead to an individual becoming obese.

## Markscheme

diet rich in carbohydrate/fat;too much food intake / unbalanced diet / food cheap and readily available;sedentary lifestyle / lack of training/exercise;genetic disposition/disorder;malfunction of hunger centre;

 **23b.** *[3 marks]*

Amino acid polarity is an important factor in determining the functions of proteins. Explain the importance of polar and non-polar amino acids in membrane proteins.

## Markscheme

polar amino acids are soluble/have stable interactions in water/extracellular fluid/cytoplasm;non-polar amino acids are soluble/have stable interactions in the lipid bilayer;polar amino acids strongly hydrophilic and non-polar amino acids are repelled by water/are hydrophobic;(help to) retain protein in position in the membrane;polar amino acids form hydrophilic channels/protein pores in membranes;transmembrane proteins have polar amino acids on either side of the membrane;

 **24.** *[2 marks]*

Outline consequences of protein deficiency malnutrition.

## Markscheme

lack of blood plasma proteins and tissue fluid retention/abdominal bloating/ swollen abdomen;kwashiorkor/marasmus develops;poor growth and development (among children);(often) mental retardation;lethargic/little interest in surroundings;wasting of muscle / thin muscles;

 **25a.** *[2 marks]*

Outline how coronary thrombosis can be caused.

## Markscheme

atheroma/fatty deposits in arteries;hardening of arteries/atherosclerosis/arteriosclerosis;rough surface causes rupture of platelets;clots form in coronary artery;

 **25b.** *[1 mark]*

State the possible cause of the curve shifting from A to B.

## Markscheme

increase in CO concentration;decrease in pH;

 **25c.** *[2 marks]*

On the graph, draw the curve for myoglobin.

## Markscheme

graph drawn to left of A; curve not sigmoid; *As shown below.*



 **25d.** *[2 marks]*

Describe the breakdown of hemoglobin in the liver.

## Markscheme

hemoglobin absorbed by phagocytes/Kupffer cells;split into heme and globins;globin hydrolysed/broken down to amino acids;iron removed from heme group / heme broken down to form bilirubin/bile pigment;

 **26a.** *[1 mark]*

State the change in blood calcium levels in normal mice 10 minutes after the administration of calcium, with and without the addition of vitamin D.

With vitamin D:

Without vitamin D:

## Markscheme

*with vitamin D:* (from 0.0 to) 1.7 μmol *(units required – allow answers in the range of 1.65 to 1.75 μmol)*

*without vitamin D:* (from 0.0 to) 1.1 μmol *(units required – allow answers in the range of 1.05 to 1.15 μmol)*

*Both needed to award the mark*.

 **26b.** *[2 marks]*

Compare the changes in blood calcium levels in normal mice and in mutant mice after the administration of calcium.

## Markscheme

a. both increase with time;

b. normal mice have a greater increase in blood calcium levels than mutant mice (after ten minutes);

c. normal mice have a maximum change of 1.1 μmol while mutant mice have a maximum change of 0.6 μmol;

d. mutant mice show gradual increase while normal mice show rapid increase followed by a plateau;

 **26c.** *[2 marks]*

Explain, using graph B, the changes in blood calcium levels for the mice with different diets.

## Markscheme

a. mice with low calcium diets have a greater increase in blood calcium levels (after calcium administration) because their body absorbs more calcium;

b. if they have had a high calcium diet they do not need to absorb so much calcium / *vice versa*;

c. probably receptors are all occupied/inhibited / less receptors;

 **26d.** *[2 marks]*

Discuss whether the scientists were able to support their hypothesis that rickets caused by the defective vitamin D receptor can be prevented by the intake of large amounts of calcium.

## Markscheme

a. hypothesis supported as blood calcium levels increased in mutant mice after intake of calcium (graph A);

b. but less than in normal mice / perhaps not enough to cure disease/rickets;

c. administering vitamin D also shows an increase in blood calcium levels (graph A);

d. but no good administering vitamin D as the receptor is defective;

e. in a high calcium diet, less absorption occurs (graph B), so might not be the solution;

f. should have tested mutant mice with different diets;

 **27a.** *[3 marks]*

Label the section of healthy liver tissue below.



I.

II.

III.

## Markscheme

I. hepatic cells / hepatocytes / liver cells / liver tissue;

II. hepatic vein / blood cells;

III. sinusoids;

 **27b.** *[2 marks]*

Outline **two** roles of the liver.

## Markscheme

a. storage of nutrients;

b. detoxification of poisons;

c. breakdown of hemoglobin;

d. production of bile pigments;

e. synthesis of plasma proteins;

f. synthesis of cholesterol;

 **27c.** *[1 mark]*

List **two** materials that are not absorbed but are egested by the body.

## Markscheme

 *Award [1] for two of the following.*

cellulose / lignin / bile pigments / bacteria / intestinal cells

*Do not accept fibre.*

 **27d.** *[1 mark]*

State an example of a protein hormone.

## Markscheme

insulin / glucagon / prolactin / somatotrophin

*Award other suitable examples.*

 **28a.** *[2 marks]*

Describe the effect of increased BMI on the risk of developing type II diabetes.

## Markscheme

higher BMI increases risk of type II diabetes / risk increases as the BMI increases;greater risk for women than for men / men have a lower risk than women;values above 25 kg m increase the risk of diabetes exponentially / BMI below 25 kg m shows minimal risk;

 **28b.** *[1 mark]*

Identify the risk of developing type II diabetes in men with a BMI of 33 kg m.

## Markscheme

21 % (*allow answers in the range of 20 % to 22 %*)

 **28c.** *[1 mark]*

Determine, by indicating on the graph, the range of age-adjusted relative risk for women who are overweight but not obese.

## Markscheme

indicated by marks on the graph on the vertical axis or on the line of the woman 8 % to 33 % (*allow 1 % error at either end*) *Information must be indicated on the graph.*

 **28d.** *[4 marks]*

Explain the dietary advice that should be given to a patient who has developed type II diabetes.

## Markscheme

moderate portions of food to avoid fluctuations in blood sugar levels;regular mealtimes to avoid fluctuations in blood sugar levels;include unrefined carbohydrates because they are more slowly absorbed; (*accept reverse for refined*)include carbohydrates with a low glycemic index; *(accept reverse for high)*include fibre-rich foods to slow absorption of sugar;limit saturated/trans fats/cholesterol because diabetes increases risk of coronary heart disease;

 **29a.** *[1 mark]*

Define *hormones*.

## Markscheme

chemical messengers secreted by endocrine glands/specialized cells directly into the blood/body fluid (and transported to specific target cells);

 **29b.** *[1 mark]*

State **one** type of hormone, giving an example.

## Markscheme

steroid hormone *e.g.* testosterone / peptide hormone *e.g.* insulin / tyrosine derivatives *e.g.* thyroxine;

 **29c.** *[3 marks]*

Compare gastric juice and pancreatic juice.



## Markscheme



*Award* ***[1]*** *for each pair.*

 **29d.** *[2 marks]*

Outline the reason for **one named** substance found in food not being digested and absorbed by humans.

## Markscheme

cellulose / lignin;cellulase not present / no enzymes for digesting lignin; *Accept any other reasonable substance.*

 **30a.** *[1 mark]*

State **one** consequence of protein deficiency malnutrition.

## Markscheme

lack of blood plasma proteins;

subsequent tissue fluid retention;

swelling of abdomen;

retarded physical and mental development of children;

muscle wastage;

 **30b.** *[3 marks]*

Outline the reasons for increasing rates of clinical obesity in some countries.

## Markscheme

sedentary lifestyle/occupations / lack of exercise;

diets high in processed contents / low in complex carbohydrates;

diets high in fat; availability of inexpensive food / large portion sizes;

 **31a.** *[1 mark]*

State which diets increase the levels of cholesterol more than a diet rich in saturated fatty acids.

## Markscheme

monounsaturated fatty acids and carbohydrates (*both required*)

 **31b.** *[1 mark]*

State the arterial lactate concentration measured at 0 m (sea level) with normoxia when exercise intensity is high.

## Markscheme

3 mmol l (*allow answers in the range of 2.8 mmol l* to 3.2 mmol l )

 **31c.** *[1 mark]*

Calculate the percentage increase in VLDL when changing from a diet rich in saturated fatty acids to a diet rich in carbohydrates.

## Markscheme

80 (%) (*units not required*)*Allow answers in the range of 80.00 to 80.20 %.*

 **31d.** *[2 marks]*

Compare a diet rich in saturated fatty acids and a diet rich in monounsaturated fatty acids.

## Markscheme

monounsaturated fatty acids has more VLDL/cholesterol/ LDL/triglycerides; *Allow numerical expressions.*monounsaturated fatty acids has (slightly) less HDL; *Allow numerical expressions.*cholesterol increases the most in monounsaturated fatty acids (in mg dl);VLDL has highest percentage increase in monounsaturated fatty acids;

 **31e.** *[3 marks]*

Evaluate the hypothesis that changing from a diet rich in saturated fatty acids to a diet rich in polyunsaturated fatty acids is healthy.

## Markscheme

less cholesterol/VLDL/LDL means lower chance of coronary heart disease/CHD;accumulation of fats in arteries leads to atherosclerosis/clots/coronary heart disease/CHD;hypothesis seems to be supported as triglycerides/cholesterol/VLDL/LDL decrease;hypothesis seems to be supported as the ratio of the LDL:HDL is lower;hypothesis seems not to be supported as HDL remains about the same;

 **32a.** *[2 marks]*

Distinguish between the mode of action of steroid hormones and protein hormones.

## Markscheme

steroid hormones enter cell while protein hormones bind to specific membrane receptors / steroid hormones can pass through cell membranes while protein hormones cannot;steroid hormones interact directly with genes/receptor proteins in the cytoplasm while protein hormones achieve their effects by causing the release of secondary messenger into the cell;

 **32b.** *[2 marks]*

Label the **four** parts of the ear indicated on the drawing below.



## Markscheme

*Award* ***[1]*** *for any two of the following correct names.*I. bones of middle ear / ossicles / malleus, incus and stapes;II. auditory nerve/ cochlear nerve;III. cochlea;IV. eardrum / tympanic membrane / tympanum;

 **32c.** *[1 mark]*

State the major role of *Helicobacter pylori* in the development of stomach ulcers.

## Markscheme

causes increased acid secretion / produces toxins / forms pores in epithelial cell membrane / produces urease which produces ammonia (which is toxic) / resides in gastric mucous protected from immune system reactions but cause inflammation and increase acid production / destroys mucus lining exposure to acid/causing inflammation

 **32d.** *[3 marks]*

Explain, using a **named** example, the cause and consequence of biomagnification.

## Markscheme

named example;definition of biomagnification;cause;consequence;

e.g.*name*: DDT / pesticide to control mosquitoes of malaria;*definition of biomagnification*: chemicals accumulate along the food chain;*cause*: as fat soluble, it accumulates in fatty tissue;*consequence*: becoming more concentrated at each trophic level / increasingly more toxic / ultimately leading to death of organism up in food chain;

 **32e.** *[2 marks]*

Discuss how the process of learning can increase chances of survival.

## Markscheme

animals learn to avoid dangerous situations/predators;animals learn how to hunt/obtain food;animals learn to adapt to changing environments;e.g. birds learn to avoid the bad-tasting black and orange caterpillars of the cinnabar moth (by classical conditioning) and thus avoid possible poisoning; *Accept any other valid examples.*

 **33a.** *[4 marks]*

Outline the use of **two named** *ex situ* conservation measures.

## Markscheme

name;use;

*example 1*:*name*: zoos;captive breeding of animals / permits assisted reproductive methods / use of modern technology;*example 2*:*name*: botanic gardens;allows for protected growth of plants / protected from extreme climatic conditions / provision of all necessary conditions;*Award* ***[1]*** *for name and* ***[1]*** *for its use.Accept other suitable examples.*

 **33b.** *[4 marks]*

Outline **two** factors that affect the incidence of coronary heart disease.

## Markscheme

*Award* ***[1]*** *for a factor and* ***[1]*** *for its effect.*

*Accept any two of the following factors with its associated effect:*e.g.: genetic predisposition / age / being male / obesity / eating too much saturated fat and cholesterol / lack of exercise / smoking / diabetes (melitus) / hypertension / stress.*Accept converse statements of factors decreasing risk.*

e.g. *factor*: genetic predisposition; *effect*: some synthesise more cholesterol/LDL than others;e.g. *factor*: being male; *effect*: women before menopause appear to be protected by higher blood estrogen levels which men do not have;e.g. *factor*: obesity; *effect*: excess weight raises blood pressure/blood cholesterol/triglyceride levels / lowers HDL/good cholesterol levels;

 **33c.** *[5 marks]*

Discuss how brain lesions and fMRI (functional magnetic resonance imaging) scanning can be used in the identification of the brain part involved in specific functions of animals.

## Markscheme

lesions (from accidents/birth) indicate effect of loss of area;*e.g.* split brain patients/severed corpus callosum led to understanding different functional roles of left and right hemispheres / other valid examples;many actions of the body involve different areas of the brain;damage may be to several/many parts so results unclear;difficult to interpret due to complexity of reactions;fMRI gives a more specific knowledge of stimulated area/activation;*e.g.* used to study/diagnose ADHD/dyslexia/recovery from strokes/music comprehension / other valid examples;non-invasive / no damage to brain;can study healthy subjects;involves blood flow/supply/oxygenation;not neuronal connections (so requires interpretation);good spatial but poor temporal resolution;problem of statistical interpretations of model; *Award* ***[4 max]*** *if either brain lesions or fMRI alone are discussed.*

 **33d.** *[5 marks]*

Explain the liver damage caused by excessive alcohol consumption.

## Markscheme

can cause inflammation/fatty liver/cirrhosis of the liver from alcohol abuse;usually from prolonged/excessive drinking / *OWTTE*;products of alcohol metabolism toxic to cells / alcohol consumption reduces antioxidant activity;replacement of healthy liver cells with fibrous/scar tissue;blocks blood flow through liver / loss of functional liver cells / blocks normal metabolic carbohydrates/fats/proteins;decreased ability to remove toxins (through bile)/bacteria / production of bile and blood proteins;nutritional deprivation / susceptible to infection/hepatic viruses;

 **34.** *[6 marks]*

Explain the role of the liver in regulating and storing nutrients.

## Markscheme

a. all nutrients arrive at the liver (from small intestine) via hepatic portal vein;

b. liver stores (excess) glucose as glycogen and releases it as needed / *OWTTE*;

c. process is (respectively) under the control of insulin/glucagon;

d. (glucose levels) controlled by negative feedback;

e. amino acids are deaminated in the liver;

f. liver produces plasma proteins/albumin/fibrinogen;

g. synthesizes/stores cholesterol;

h. liver stores iron from the breakdown of hemoglobin in red blood cells;

i. liver stores vitamin A/vitamin D;

 **35.** *[6 marks]*

Explain the events of the cardiac cycle, including the heart sounds.

## Markscheme

a. during diastole the heart muscles/atria/ventricles are relaxed;b. blood enters the atria;c. during atrial systole the atria contract and blood moves into the ventricles;d. pressure (in ventricles) causes bicuspid/tricuspid/AV valves to close;e. (this) closing of valves causes first heart sound;f. during ventricular systole the ventricles contract causing blood to flow to aorta/pulmonary artery/arteries/out of heart;g. semilunar valves close so blood does not return to the ventricles;h. this causes the second heart sound;i. blood leaving atria/ventricles during contraction is caused by increased pressure which reduces volume;

 **36.** *[6 marks]*

Explain the mechanisms used by the ileum to absorb and transport food.

## Markscheme

absorption occurs through epithelial cells on villi/tiny projections;microvilli/brush border on cell membrane increase surface area;tight junctions prevent leakage of nutrients;lipids/fat soluble/non-polar substances diffuse across membranes;converted into tryglicerides / coated with proteins to form chylomicrons/lipoproteins;which enter into lacteals/lymphatic system by exocytosis;fructose/hydrophilic food enters by facilitated diffusion/through channel proteins;active transport requires ATP (from many mitochondria in cells) / against concentration gradient through pump proteins;*e.g.* glucose/amino acids/minerals enter through co-transported sodium carriers;endocytosis of large molecules (*e.g.* vitamin B12) / pinocytosis of liquids;capillaries (close to epithelial cells) transport substances (to body via bloodstream);

 **37.** *[6 marks]*

Explain the role of the SA (sinoatrial) node in the cardiac cycle.

## Markscheme

SA node is located in the wall of right atrium of heart muscle;has characteristics of both nerve and muscle tissue;SA node initiates each impulse;acts as pacemaker of the heart;no nerve impulses needed for contraction / myogenic;connected to nerves which slow/accelerate heart rate;impulses spread out in all directions through walls of atria;stimulates atrial systole/contraction;fibres in walls of atria prevent impulses from reaching ventricles;impulses reach AV node (after atrial contraction);

 **38a.** *[6 marks]*

Discuss international measures that would promote the conservation of fish.

## Markscheme

a- require international agreement/cooperation;b- difficulties of enforcing agreements / to determine maximum sustainable yield / to obtain and interpret data / monitor populations/stocks;c- economic consequences for livelihood of fishermen/associated trades;d- total ban on fishing in threatened areas/endangered species/exclusion zones;e- limiting size of fish caught / limits on size of net mesh / ban on drift nets / indiscriminate in species of fish caught;f- limiting size to total allowable catch/quotas;g- limiting fishing to non-productive periods of fish / closed seasons banning fishing during breeding season;h- reducing fishing days at sea / fixing number and type of vessels authorized to fish;i- regulation on pollution of bodies of water;j- use of fish farms;

 **38b.** *[6 marks]*

Explain with the use of a diagram, the role of the Bohr shift in the supply of oxygen to respiring heart muscle.

## Markscheme

*diagram with correct labels:*a- partial pressure O/percentage O saturation on *x*-axis and percentage saturation hemoglobin with Oon *y*-axis;b- exponential shape curve at lower partial pressure/concentration of CO;c- curve shifted to right (and lower) for higher partial pressure/concentration of CO;



d- hemoglobin carries (up to) four oxygen molecules; e- Bohr shift promotes the release of oxygen in respiring heart muscle; f- active respiration releases CO; g- partial pressure of CO increases; h- increases acidity/lower pH/increase lactic acid; i- hydrogen ions bind to hemoglobin / which decreases hemoglobin’s affinity for O; j- so O is released (from the oxyhemoglobin); k- allosteric effect / conformational change in hemoglobin which releases O more readily;

*Award* ***[4 max]*** *if no diagram provided.*

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