M1. (a) (i) points correctly plotted

all correct gains 2 marks
2 correct gains 1 mark

each part of line correctly drawn (i.e. curve + straight line)

for 1 mark each part of line

4

(ii) 3 (or according to plotted graph) litres per second

for 1 mark each

2

(b) lungs
blood

for 1 mark each

2

(c) (i) *ideas that*

- energy transferred <u>faster</u> in 100m race
- carbon dioxide produced faster during 1500m race / more
- carbon dioxide produced

for 1 mark each

3

correct reference to twice / half as fast in either / both cases

for a further mark

1

(ii)

- respiration during 100m race (mainly) anaerobic
- respiration during 1500m race (mainly) aerobic
- aerobic respiration produced carbon dioxide
- anaerobic respiration produced / lactic acid

for 1 mark each

1

[13]

M2. (a) (i) (too) cold / all moisture / <u>water</u> frozen / no moisture / no warmth / conditions for decay are absent.

for 1 mark

(*No* oxygen is neutral)
(*Do not accept* frozen or ice has preserved them)

1

(ii)

- (bacteria have) no oxygen / air (because dead fish covered in mud)
  (No moisture x)
  (No moisture and no oxygen or warmth x)
- bones / hard parts do not decay easily

idea that

- material of fish replaced by minerals

any two for 1 mark each

2

(b) *ideas that*

- mammoths lived at the same time as humans / there was man in these times
- mammoths lived in the same place as humans
- humans hunted mammoths / ate mammoths / were carnivorous / for fur etc
- reference to later use of more advanced weapons
- humans needed to protect themselves from mammoths
- humans used flints / weapons / tools

any two for 1 mark each

2

(c) *idea that*

- environment changed / became too cold / became too warm /

vegetation changed / humans destroyed environment

- (new) predator / humans killed them
- new disease
- new competitor / type of elephant
- shortage of food / no food / ran out of prey
- mammoths reproduced too slowly
- mammoths didn't adapt to changes

any two for 1 mark each

2

[7]

M3. (a) sexual / sex

for 1 mark

1

(b) *idea that*
sexual reproduction brings about a mixture of genes
or similar / different genes / parents / gametes / DNA /
characteristics / chromosomes (*not* features)

for 1 mark

1

(c) (i) asexual / cloning (*allow* vegetative)

for 1 mark

1

(ii) (A) *idea that* (they are exactly the same). *Do not allow*
similar or just <u>one</u> named feature.

for 1 mark

2

(b) different (*allow* similar but *do not allow* same).
Allow any one named difference

for 1 mark

(d) (i) greater the X-ray dose, greater the % of mutations
or % of mutations increases steadily / in proportion to X-ray dose

for 1 mark

1

(ii) ionising radiations / ultra-violet light / alpha particles / beta particles / gamma rays / radio activity / chemicals / drugs / smoking / natural in meiosis / spontaneous / cell replication / toxic waste / pollution

1

Accept radioactivity but not radiations alone.

for 1 mark

[7]

M4. (a) *idea about*

- environment change / habitat drier / climate change
- couldn't escape from predators / ref to predators / killed / eaten

  [Do not allow "died"]
- because feet not adapted to run on dry ground
- couldn't compete (with Merychippus) / more difficult to get food

[Use v + x = x principle]

any two for 1 mark each

2

(b) (i) fossil remains / from the bones

for 1 mark

1

(ii) (known) age of rock **<u>or</u>** any reason for knowing the age of the rock eg by the rock layers by RA dating (not C-dating)

for 1 mark

1

(c) *idea that*
(present day) horses / species evolved / adapted / developed <u>from earlier species</u>/ <u>horses</u>

- over a long period of time / millions of years
- via many / gradual changes

- which gave a survival advantage /passed on genes / characteristics

any three for 1 mark each

[First bullet point answer is required before marks can be awarded for others]

3

[7]

M5. *ideas for*

- more food produced/increased yield
- cheaper food
- bigger income for farmer (allow profit)
- less loss/damage/spoilage of crop
- allow less wasted growth (of straw due to drawing)

any three for 1 mark each

3

ideas against

- chemicals harm people (do not accept "affect flavour")
- fertiliser costly
- fewer worms (in soil)
- weedkillers kill valued/useful wild plants
- insecticides/pesticides kill useful insects/other animals

(general idea that chemicals harm plants/animals gets only 1 of these)

- (weedkillers insecticides/pesticides/fungicides/hormones/chemicals) contaminate water
- (increased risk) pesticide resistance over production/food mountains
- possible eutrophication/nitrate in river/extra plant growth/
- explanation of eutrophication

for 1 mark each to a maximum of 4 marks

4

[7]

M6. (a) *idea*

identical (do not allow simply “the same number”)

for 1 mark

1

(b) *idea*

chromosomes double/duplicate/copies made

for 1 mark

separate into 2 sets/divide*

gains 1 mark

but

separate into 4 sets/divide twice*

gains 2 marks

number halved compared to bodycell

or

single set (only) 16

accept in terms of cells but only if chromosomes referred to in first and/or last items)

for 1 mark

4

[5]

M7. (a) (i) *ideas that*

- remains of animal/plant of specific organism
- (from) many years ago/thousands or millions of years

- found in rocks/covered by sediments

for 1 mark each
Mark (a) as a whole to a total of 5 marks.

3

(ii) *ideas that*

- hard parts/bones/shells/skeletons

link required

- don't decay

or

- no decay

link required

- conditions needed absent/no oxygen/no water

or

- parts replaced by rock mineral chemicals;
  Do not accept 'materials' or 'substances'.
- as they decay

Accept 'hard' or 'soft' parts for 1 mark each

2

(b) *idea*

died out/none left/died off

Do not accept 'died' alone
for 1 mark

1

[6]

M8. *idea*
provide (more) light
provide (more) CO_2

provide (plenty of) water
if any one of these is low it will limit the reaction
[Do not allow answers referring to temperature,
as optimum is specified in question 3)

any three for 1 mark each

[3]

M9. extinct (NOT fossils)
fossils
bones
rocks

each for 1 mark

[4]

M10. (a) line increasing in daylight 6 – 18 ($\pm$ 2 hr)
line decreasing 0 – 6 ($\pm$ 2 hr)
line decreasing 18 – 24 ($\pm$ 2 hr)

for 1 mark each

but
mirror image (i.e. opposite gradients)

gains 3 marks

3

(b) *idea:*
slower growth (credit even if refers only to leaves)
less photosynthesis/glucose (than if leaves fully green)

each for 1 mark

2

[5]

M11. (a) *idea:*
mental/brain deterioration
involuntary muscular movement/fidgety
starts in 40/50's/middleage
for 1 mark each

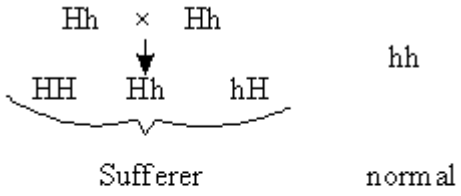
3

(b) *ideas that:*
mother homozygous *
father heterozygous * (*these terms not essential)) these marks
) can be gained
allele dominant (H. chorea)) on diagram*
children normal or heterozygous
chance 50/50

Diagram gains max. 3 marks
for 1 mark each

4

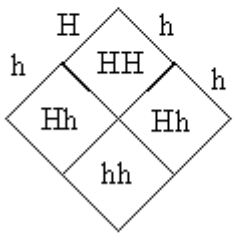
(c) 3 in 4 chance (or 3:1) (of Huntington's chorea)
gains 1 mark



or

	H	h
H	HH	Hh
h	hH	hh

or



or equivalent in words
gains 1 mark

2

[9]

M12. (a) *idea:*
wood goodness recycled/crops goodness removed
gains 1 mark

1

but
wood minerals/nutrients recycled/crops remove nutrients/minerals
gains 2 marks

wood and crops compared
for 1 mark

2

(b) (add) fertiliser/nutrients/minerals
(add) manure/animal waste/compost
any two for 1 mark each

(accept move to new area for 1 mark)
rotation
max marks 2

2

[5]

##

(a) *idea that*
thicker/sticky/viscous mucus;
difficult breathing/trachea blocked;
digestion difficult/glands blocked
each for 1 mark

3

(b) *idea*
'normal' gene/allele dominant

or
cystic fibrosis gene/allele recessive;

idea that
parents heterozygous/carrier;
children heterozygous, homozygous dominant,
homozygous recessive (clearly implied by diagram);
idea one in four chance of cystic fibrosis
each for 1 mark

4

[7]

M14. (a) circles round right hand **X** and **Y** gametes
*put two ticks **or** crosses by the circles*

2

(b) 50:50 **or** 1:1 **or** 50% **or** 0.5 **or** ½ equal **or** evens
credit even
*do not accept 2:1 **or** 50 / 50*

1

(c) (i) 23

1

(ii) 23
credit the same as the one above to be marked consequential

1

(d) DNA
do not accept nucleic acid

1

(e) same

1

[7]

M15. (a) (i) mouth **or** saliva
accept small intestine

1

starch

1

maltose **or** glucose
do not credit sugar

1

(ii) small intestine
*accept duodenum **or** jejunum*
do not credit intestines

1

fats **or** lipids **or** oils

fatty acids **or** glycerol

2

(b) (i) salivary
accept pancreas

1

(ii) pancreas
*accept small intestine **or** ileum*

1

[8]

M16. (i) any **two** from

* (heart) more muscular
accept bigger

* (heart) more powerful
accept more efficient
accept stronger

2

(ii) * pauses longer between (heart) beats

accepts beats more slowly

accept heart rate decreases

* less fast around the heart

recovers more quickly not just 'heart healthier'

do not credit pulse rate slower

2

[4]

M17. (i) 6 in both spaces

do not credit if any formula has been altered

1

(ii) glucose

*allow fructose **or** dextrose*

1

(iii) mitochondria

accept organelles

1

[3]

M18. (a) (i) the three features correctly labelled on cheek cell (which are referred to in part (ii)

label lines should touch or end very close to part no marks if leaf cell labelled

nucleus

cytoplasm

cell membrane

mitochondrion

accept mitochondria or one of these could be labelled

vacuole

3

(ii) any **three** from

feature	**function**
nucleus	controls cell
	*accept contains genetic material **or** genes **or** chromosomes **or** stores information*
	do not credit the brain of the cell
cytoplasm	where respiration occurs
	*accept contains food **or** mitochondria*
	or reactions occurs
membrane	less water **or** chemicals
	accept surrounds the cell or lets some things in but not others
	*do not credit keeps things out **or** protection*
	in and **or** out
mitochondria	where energy released
	ecf from leaf cell labelling
	*accept chloroplasts make sugar **or** glucose*
	accept vacuole contains sap
	*accept if cell wall mis labelled on cheek cell, support **or** hold together*

3

(b) fight **or** ingest **or** kill bacteria **or** germs **or** viruses **or** microbes

accept produce antitoxins or antibodies fight disease (organisms)

do not credit fungus

1

(transport) oxygen **or** carry haemoglobin

*accept transport carbon dioxide **or** helps form scabs*

1

[8]

M19. (a) 6 6 6

all required

accept a '6n 6 n n 6n' version of the balanced equation provided it is correct in every detail

1

(b) any **two** of

- (presence of) chlorophyll **or** (amount of) chloroplasts

  accept green leaves (or other green parts)

- (sufficient) light (intensity)

- (light) of **a** suitable wavelength

  any light other than green light

  do not credit Sun's energy or sunshine or Sun

2

(c) **guard cells**

any **two** of

* control by osmosis
* the movement of gases

*accept movement of carbon dioxide **or** oxygen **or** water vapour beware movement of CO_2 out*

accept a diagram or description

* through the stoma

2

palisade cells

any **two** of

* near the upper surface
* contain (a great) <u>many</u> **or** <u>more</u> chloroplasts
* (so) contain the most chlorophyll

2

(d) any three of

* for respiration
* conversion to (insoluble) starch

or to food store **or** to (other)carbohydrates
* (conversion to) sucrose **or** to food store **or** to (other) carbohydrates

or polysaccharides

*do not credit just to grow **or** live*

***or** survive*

accept conversion to food store

***or** to (other) carbohydrates once only*

* (conversion to) lipids **or** fats **or** oils
* (conversion to) amino acids **or** (plant) proteins **or** auxins **or** (plant) hormones **or** enzymes

3

[10]

M20. (a) (i) XX XY XY XX

female male male female

the four correct genotypes and sex are required they may be in any order

1

(ii) meiosis

correct spelling required but

accept meisosis not miosis or meosis

1

(iii) 23

1

(iv) 23

1

(b) (i) any **two** from

(introduces) variation

*accept can crossbreed **or** offspring may gain beneficial characteristics*

prevents the risk of all being the same
and a disease wiping out population
or prevent monoculture

two parents to raise offspring

2

(ii) both parents carry a recessive allele
or gene **or** are heterozygous
accept both parents are carriers

1

[7]

M21. (i) (aerobic) respiration
do not credit anaerobic respiration
accept cellular respiration

1

(ii) carbon dioxide and water (vapour)
both required
do not credit heat

1

[2]

M22. use less nitrate / fertiliser
accept use none
use a different fertiliser is neutral
prevent nitrate fertiliser run off is neutral

1

any **two** from:

explanation that with less or none the crops still grow

make more land available to grow more crops

monitoring of water

legislation

organic farming / manure

genetically modified crops

give babies bottled water

2

[3]

M23. (a) any **three** from:

factor for colour has two forms
accept gene for factor and allele for form

yellow dominant since all first generation yellow
accept F1 for first generation

green recessive since reappears in second generation
accept F2 for second generation

3

(b) (i) genes
accept alleles / genetic

1

(ii) nucleus
accept chromosomes / DNA

1

[5]

M24. man XY
allow (chromosomes) different

1

woman XX
allow (chromosomes) same
genes and alleles are neutral

allow 1 mark for one is XX and one is XY

1

[2]

M25. (a) 11

accept 10.5 – 11.5

1

(b) ideas of

increase / rises

1

frequently / often

1

energetically / violently

1

[4]

M26. (a) (i) carbon dioxide / CO_2 (*reject* CO)

(ii) oxygen / O_2 / O (*reject* water vapour)

for 1 mark each

2

(b) (provides) energy

for 1 mark

1

[3]

M27. (a) woman XX
man XY

for 1 mark each

2

(b) 50% / 1 in 2 / evens / 0.5 / 50:50

for 1 mark

mark scheme for genetic diagram

gametes all correct
genotypes of offspring all correct in relation to gametes

for 1 mark each

1

mark scheme for written explanation

half sperm have X chromosome, half have Y
and
all eggs have X chromosome

50% / 1 in 2 / evens / 0.5 chance of egg being fertilised by X or Y sperm

for 1 mark each

2

[5]

M28. (a) (cell) wall
(cell) membrane
cytoplasm
vacuole

for 1 mark each

4

(b) (i) A

(ii) B

for 1 mark each

2

(c) diffusion (*reject* osmosis)

for 1 mark

1

[7]

M29. (a) chromosomes
genes (*reject* alleles)
alleles

for 1 mark each

3

(b) (i) sexual / sex

for one mark

1

(ii) egg / gamete / sex cell / ovum (*reject* ovule)

for one mark

1

(c) (i) information / genes / DNA passed from parents (*reject* chromosomes)

for one mark

1

(ii) genes / genetic information / chromosomes from <u>two</u> parents
alleles may be different
environmental effect / named may have been mutation

any two for 1 mark each

2

[8]

M30. cytoplasm reject protoplasm
(cell) membrane
nucleus

all correctly labelled
each for 1 mark

[3]

M31. (a) Sun / sunlight / light

for 1 mark

1

(b) (i) 21.5 – 22 ***and*** 27 – 27.5

for 1 mark

1

(ii) ideas of limiting factor / shortage of
e.g. light / carbon dioxide / water /chlorophyll

each for 1 mark
(allow 1 for 'maximum' rate of enzyme activity if no reference to limiting factors)
(ignore reference to dematuring)

2

(iii) 21.5 – 22° C

(allow first figure from answer to (i) so that no 'double-penalty' <u>but</u> not below 20)

maximum rate of photosynthesis
(can relate to any number on 'flat')

most economical heating (must relate to left end of 'flat'
each for 1 mark

3

[7]

M32. (a) 10

for 1 mark

1

(b) digested / broken down / made soluble by protease / enzyme
in stomach / in small intestine / from stomach / from pancreas
into amino acids amino acids/smaller molecules/products of digestion absorbed into blood

any four for 1 mark each

4

[5]

M33. D

idea that twins have come from one (fertilised) egg
idea that Y sperm / Y chromosome produces boys

each for 1 mark
*allow 1 mark if candidate selects **A and** states that Y sperm / Y chromosome produce boys (reject Y gene unqualified) OR*
*allow 1 mark if candidate selects **C and** states that twins must have come from one (fertilised) egg*

[3]

M34. (a) (i) D

for 1 mark

1

(ii) D Y (*both*) or C X (*both*) or B W (*both*)

for 1 mark

1

(b) *N.B. answers must relate to fossils <u>providing evidence</u>*
show types of animals / plants that <u>no longer exist</u> / named ref eg dinosaur
show <u>changes</u> in types *(of animals / plants)*
similar fossils found in rocks of similar age
reference to sequence of change
or example
e.g. horse / limb

any two for 1 mark each

2

[4]

M35. (a) (i) D

for 1 mark

1

(ii) D Y (*both*) or C X (*both*) or B W (*both*)

for 1 mark

1

(b) *N.B. answers must relate to fossils <u>providing evidence</u>*
show types of animals / plants that <u>no longer exist</u> / named ref eg dinosaur
show <u>changes</u> in types *(of animals / plants)*
similar fossils found in rocks of similar age
reference to sequence of change
or example
e.g. horse / limb

any two for 1 mark each

2

[4]