Infectious disease

Mark Scheme 2

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Infectious disease
Sub Topic	Infectious disease
Booklet	Theory
Paper Type	Mark Scheme 2

Time Allowed : **70 minutes**

Score : **/ 58**

Percentage : **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 **(a)** parental genotypes ; e.g. AaBb x AaBb
gametes ;
correct use of punnett square ;
F1 genotypes ;
F1 phenotypes ; (must link to genotypes)
yellow and sphere $^{1}/_{16}$; **[6]**

(b) **(i)** contract / die from, malaria ; **[1]**

(ii) contract / die from, sickle-cell anaemia ; **[1]**

(c) resistant to malaria ;
detail ;
more likely to survive ;
and reproduce ;
pass on sickle-cell allele ; **[3 max]**

[Total: 11]

2 (a)

*Award one mark per column. No penalisation for complete lack of **all** crosses (or **all** ticks) unless mixture of x and ✓ missing as agreed*

statement	emphysema	tuberculosis	obesity	rickets	smallpox
eliminated by vaccination	x	x	x	x	✓
a worldwide infectious disease	x	✓	x	x	✓ or x
a form of malnutrition	x	x	✓	✓	x
a deficiency disease	x	x	x	✓	x
involves degeneration of lung tissue	✓	✓ or x	x	x	x

[Total 5]

3 **(a) (i)** alveoli **;** **A** alveolus / aveoli [1]

(ii) emphysema **;** **A** emphasema etc. [1]

(b) damage / paralyse / destroy / inhibit, cilia / ciliated epithelium **;**
goblet cells, enlarge / produce more mucus **;**
mucus, accumulates / not swept away (by cilia) **;**
bacteria / pathogens, can multiply in mucus / AW **;** **A** grow in mucus
I mitosis
bacteria / pathogens, not removed **;**
increased time available to infect cells **;**
AVP **;** e.g. increased permeability of alveolar walls to pathogens depressed antigen-presenting ability of lung macrophages [max 3]

(c) CO, binds to / combines with / joins with, haemoglobin **;**
A forms carboxyhaemoglobin
I carbaminohaemoglobin

binding is irreversible / carboxyhaemoglobin is stable / AW **;**
R carbaminohaemoglobin is stable

haemoglobin, cannot become fully saturated with oxygen / has a lower affinity for oxygen / carries less oxygen / AW **;** **A ora**
R 'carries no oxygen' [max 2]

4 (a (i) *penalise once if the term genetic material is used instead of DNA*

1 no nuclear envelope / no (true) nucleus ;
A no nuclear membrane
A no nucleus envelope
A DNA free in cytoplasm ora
A DNA as nucleoid

2 DNA, loop / circular ;
A DNA not linear

3 DNA, not in chromosomes / DNA not associated with, histones / proteins ;
A naked DNA

4 no nucleolus ;

5 (presence of) plasmids ;

6 (only) have, 70S / small / 18–20 nm, ribosomes ;

7 presence of, capsule / slime layer ;

8 ref. small (cell) size / less than 5 μm / (only) 1 μm ;
A ora for eukaryotes [max 3]

(ii) *plant cell*
cellulose ; *treat as neutral ref. to microfibrils / fibres*

bacterial cell
murein / peptidoglycan ;
A peptoglycan / polysaccharide and amino acid [2]

(b) 1 cell contents shrink / cytoplasm shrinks ; AW
R cell shrinks *unless clear that the cell wall remains, intact / same size*

2 cell (surface) membrane / plasma membrane, peels away / AW, from cell wall ;
A plasmolysis occurs **/** cell becomes flaccid

3 (movement of) water out by osmosis ;
4 down water potential gradient / from high to low water potential / to lower water potential /from less negative to more negative water potential ;
A ψ for water potential [max 3]

(c) 1 (mutation involves) change in sequence of, bases / nucleotides (of DNA);
A (mutation leads to) altered, mRNA / codons
A change leads to new alleles
(genes code for, polypeptides / proteins, so)

2 different, protein structures / proteins, possible / synthesised ;
A different, primary / tertiary / 3-D, structure

3 (so) range of / different, functions possible / AW ; [max 2]

[Total: 10]

5 **(a)**

name of disease	type of causative organism	name of causative organism
cholera	bacterium / bacteria	*Vibrio cholerae*
HIV / AIDS	virus	human immunodeficiency virus;
malaria	protoctist; **A** protozoa / protista **A** apicomplexa / sporozoa	*Plasmodium, vivax / ovale / falciparum / malariae;* **A** *Plasmodium (spp)*
tuberculosis (TB)	bacterium / bacteria;	*Mycobacterium tuberculosis*

[4]

(b) (i) cholera; [1]

(ii) antibiotics / antibacterials / antimicrobial and one reason;
e.g. kill / inhibit, bacteria
bacterial infection / caused by bacterium
do not kill humans
A harmless to human / AW [1]

(iii) 1 vaccinated children, are immune / AW;
ignore resistant
2 herd effect;
3 explained; e.g. sufficient / AW, vaccinated / immune, to prevent spread (to susceptible individuals)
4 example of another factor that became effective; e.g. less money spent on drugs so more for better diet
prevention method described to avoid, food / water, contamination [max 2]

(c) (i) 1 bacterial (surface) antigens / epitopes, act as, non-self / foreign antigens;
2 human cells have self antigens;
3 (antigens are), proteins / polysaccharides;
4 (non-self antigen) will trigger phagocytosis / phagocytes have receptor (only) for, bacterial / non-self, antigens / proteins; **ora** for self antigens
5 ref. to non-self and self antigens containing different sequences of amino acids / self antigens are products of body's genotype / AW;
6 *idea that* phagocytes bind to antibodies complexed with (non-self) antigens (and human cells will not have bound antibody); [max 3]

(ii) *any reasonable; e.g.*
mechanism to prevent, phagosome formation / lysosome fusion with phagocytic vacuole
able to withstand attack by (hydrolytic) enzymes
contain enzyme inhibitors
able to degrade (hydrolytic) enzymes
protective capsule [max 1]

(iii) reduction in numbers of T (h) lymphocytes; **A** CD_4 (cells) macrophages
ref. to role of T(h) cells e.g. enhanced humoral response, increase macrophage action;
lowered immune system / poor immune response / AW; e.g. unable to produce sufficient T/B cells / insufficient stem cells available [max 2]

[Total: 14]

6 **(a) (i)** *(estimated) number of newly infected people*

1 increases (steeply) (from 1990) until 1996 / 1997 **;**
2 peaks at, 3.5 million / any figure between 3 and 4 million / 3 to 4 million **;**
3 (gradual) decrease from, 1996 / 1997 **;**
4 number of new cases in 2008 is greater than in 1990 **;** [max 3]

(ii) *stated precaution(s) to reduce risk of infection by*

1 using, condoms / femidoms **;**
A safe(r) sex / use protection during sexual intercourse
2 abstinence / monogamy / less promiscuity **;**
3 not sharing needles / using sterile needles / needle exhange **;** **A** syringes
4 not breast feeding **;**
5 (heat) treated blood (products) / testing potential blood donors or donated blood **;**

6 ref to contact tracing **;**
7 increased awareness of, precautions / risks / transmission **;**
8 increased use of (antiviral) drugs reduces transmission **;**
9 some strains are less infective than others **;**
10 less reporting of new cases **;**
11 AVP **;** e.g. fewer HIV+ babies born (to HIV+ mothers)
improved, screening / detection, qualified [max 3]

(b) *idea that* estimates are subject to large uncertainty / AW **;**

idea that needed for any use of the data for planning health services / AW **;**

AVP **;** e.g. *explanation of mp 1 rather than general statement, such as*
symptomless carriers
many new cases not diagnosed
many new cases not reported
remote areas [1]

(c) 1 increase in new infections of HIV linked to increase in deaths from HIV/AIDS **;** ora
in context of time delay
A small number deaths in 1990 as few infected eight years before
2 HIV/AIDS may take several years to develop after HIV infection **;**
3 peak for new infections is in 1997 and for deaths is 2005 (delay of 8/9/10 years) **;**

number of deaths in always lower than number of new infections
4 comparative data quote in support of lower number of deaths than infections **;**
5 not all HIV+ people die from HIV/AIDS (over period of study) **;**
6 not all HIV+ people, have / develop, AIDS **;**
7 many deaths of HIV+ people recorded as due to, (named) opportunistic infections **;**
8 (antiviral) drugs delay, AIDS / opportunistic infections / AW **;**

9 AVP **;** e.g. cheaper drugs / greater availability of drugs [max 4]

[Total: 11]