The gas exchange system and Smoking

Mark Scheme 7

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Gas exchange and smoking
Sub Topic	The gas exchange system and Smoking
Booklet	Theory
Paper Type	Mark Scheme 7

Time Allowed : **72 minutes**

Score : **/ 60**

Percentage : **/100**

Grade Boundaries:

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

1 **(a)** **A** to cilia; **R** basal body
B to nuclear membrane;
C to ER; **[3]**
must have label lines which touch appropriate place

(b) cilia are, absent/destroyed/damaged/not functioning; **R** killed
mucus is not moved/swept away;
mucus, remains/accumulates, in airways qualified e.g. lungs/alveoli/bronchi;
pathogens/bacteria/viruses/fungi, are not carried away/are trapped;
pathogens, reproduce/divide/multiply/spread;
ref to conditions for their growth; **[max 3]**

(c) there is no positive correlation AW e.g. no link/no direct connection,between increased cigarette consumption and number of deaths;
use of comparative figures to support this; **both no of cigarettes and deaths must be quoted (2 sets of figs needed)**

Any one other valid mark from the following:
people die before COPD develops (sufficiently);
only 20 countries;
cause of death may not be recorded accurately/maybe other cause(s) recorded on death certificate;
COPD contributed to death but not main cause;

maybe other factors contribute to developing COPD eg. air pollution/occupation/ climate/population density;

maybe other factors involved with smoking are more important e.g. number of years smoked/number of cigarettes smoked by smokers;

ref to correlation coefficient;
for the data it is 0.05 **[max 3]**

[Total: 9]

Question	Expected Answers	Marks
2 (a)	correct measurement of scale bar used as basis for finding magnification with appropriate working; A. 1.7 - 1.9 cm for length of scale bar e.g. $\frac{\text{xx mm x 1 000}}{10}$ = X xxxx; A. any fig. between x 1700 - 1900 N.B. award one mark if correct answer given without any working shown	2
(b)	movement of air / oxygen into alveoli; concentration gradient (between alveolar air and blood) / AW (for either oxygen or carbon dioxide); oxygen dissolves in film of liquid / surfactant fluid; diffusion; oxygen and carbon dioxide exchanged (idea of); squamous / alveolar / pavement epithelium; } A. alveolar/capillary endothelium (of capillary); } wall once red blood cell; ref to short diffusion distance into capillary / one cell thick / 2-3 μm; R. thin wall	4 max
(c)	B lymphocyte / B cell / plasma cell;	1
(d)	secretion of mucus by, goblet cells / glands; fluid leaks from capillaries; R. capillaries permeable contraction of (smooth) muscle / muscle spasm; congestion / blocking / narrowing / AW, of airways / bronchioles; increased resistance to air flow / air flow restricted;	3 max
		[Total : 10]

Question	Expected Answers	Marks
3 (a)	stomata (are open) for gas exchange / CO_2 / O_2 uptake / release (for photosynthesis and respiration); large surface area / many cell surfaces; in spongy mesophyll; (so) evaporation from (damp) walls (into air spaces); (and) diffusion / loss down a conc. gradient, of water vapour; to air / atmosphere via stomata;	**3 max**
(b)	ref cohesion / tension (in context of xylem); hydrogen bonds; through (freely permeable) cell wall / apoplast pathway; through partially permeable membrane / AW (in context of cell B); osmosis; down water potential gradient / high / less negative to low / more negative water potential / AW;	**3 max**
(c) (i)	**B** to **A** and **C**; **A** to **C**;	**2**
(ii)	from cell surfaces through air through stomata;	**1**
(d)	small leaves / small surface area / reduction of leaf surfaces / needle shaped leaves; R. spines rolled / curled leaves; R. folded shed leaves; sunken stomata / stomata in pits / crypts / grooves; stomata surrounded by hairs / hairy leaves; waxy / impermeable / thick, cuticle / thick leaves qualified;	**2 max**
		[Total : 11]

4 **(a** **1** caused by, a pathogen **;**

2 transmissible / communicable **; A** passed from, person / animal, to person
ignore contagious

in context of tuberculosis
3 (pathogen is) a bacterium / *Mycobacterium (tuberculosis / bovis)* / *M. tuberculosis* / *M. bovi* **;**

4 mode of transmission detail **;** *one from*
aerosol / droplet, infection / transmission
in droplets, from (infected) person, exhaling / AW / coughing / sneezing / talking in droplets, / inhaled / AW, by (uninfected) person
person, drinks (unpasteurized) milk / eats meat, from infected cattle
if both of these given this is also mp 2

A contaminated, milk / meat [max 3]

(b) **1** kill bacteria / bactericidal **; A** cause bacteria to, lyse / burst **A** destroy

2 (or) bacteriostatic / prevents bacterial growth / prevents bacterial replication**;**
A ref. to preventing protein synthesis / inhibiting metabolic reactions

3 ref. to preventing spread (of bacteria) within body **; A** prevents reservoir for re-infection

4 do not affect, human cells / human tissue / not toxic (to humans) **;**

5 prevents death / consequences may be fatal if no antibiotic treatment / AW **;**
A ref. to, alleviating symptoms / faster recovery
A restores good health / person feels well again / person cured

6 ref. to role in preventing, transmission / spread, of disease **;** *do not confuse with mp 3*

7 ref. to (antibiotic) treatment of TB **;** e.g.
one of isoniazid, rifampicin (rifampin), pyrazinamide, ethambutol, streptomycin
one of 6–12 months (latent), longer for active disease, two years or more for drug-resistant forms
need combination treatment if active disease
ref. to, MDR-TB / multidrug- resistant TB *or* XDR-TB / extensively drug-resistant TB

8 part of DOTS regimen / described **;**
(directly observed therapy short-course / direct observation treatment short course)

[max 4]

(c) **1** statistical, correlation / link / association, between smoking and TB **;** AW
A another valid suggestion in addition to mps 2-6 suggesting link

2 where TB, cases / death rates, are high tobacco smoking is also high **;**

3 in areas where there is, no overcrowding / AW, smokers have higher number of TB cases **;**

4 (ref. projects) death rates from TB reduced where patients stop smoking **;**

5 higher cases TB in work places where smoking occurs **;**

6 higher cases of TB in children living with parents who smoke **;** [max 2]

(d) **1** lack of / paralysed / AW, cilia, so mucus, not wafted away / accumulates **;**

R dead cilia

2 pathogen / bacteria / *Mycobacterium*, remains in lungs / accumulates **;**

3 ref. to increased opportunity / AW, for bacteria to, enter cells / infect **;**

4 nutrients provided by excess mucus encourage growth **;** AW

5 smoking weakens the immune system **;**

6 detail **;** e.g. fewer / less active / AW, phagocytes / macrophages [max 3]

(e) coronary bypass (surgery) / coronary artery bypass (graft) **;**
A bypass, surgery / graft / operation
R heart bypass
heart transplant **;**
angioplasty **;**
stent (insertion / AW) **;** [max 2]

[Total: 14]

5 **(a** *max 3 if no attempt at comparison*

evaporation

1 formation of water <u>vapour</u> from water / conversion of water from liquid (form) to gas(eous form) **;**

2 requires, energy / heat **;**

3 (water loss) from, <u>surface</u> / <u>cell walls</u>, of (spongy) mesophyll (cells)**;**

transpiration

4 idea of loss of water <u>vapour,</u> to external atmosphere / from the aerial parts of a plant **;** **A** from leaves

5 ref. <u>diffusion</u>, down water potential gradient / from high to low water potential / from less negative to more negative water potential **;** **A** Ψ for water potential

6 through stomata **;**

air spaces

7 correct ref. to, intercellular / air, spaces **;** e.g. evaporation into air spaces, diffusion from air spaces through stomata [max 4]

(b) (i) *max 3 if no attempt at explanation*
penalise once for lack of units
mp for describing shown by (D)
mp for explaining shown by (E)

temperature

T1 (D) (mean) transpiration rate hot dry day lower than warm dry day ;
A lower than warm rainy day **A** lowest rate

T2 (D) comparative data quote to support **;**

T3 (E) stomata close to prevent excess water loss / excessive water loss causes closure of stomata **;** AW

humidity

H1 (D) (mean) transpiration rate warm dry day higher than warm rainy day **;**
A highest rate

H2 (D) data quote to support **;**

H3 (E) decrease in / low, humidity increases rate of, transpiration / evaporation / diffusion **;** ora

H4 (E) more steep / AW, water potential gradient **;**

stomatal density

S1 (D) peach (mean) transpiration rate, lowest / lower than, apple / sour cherry **;**

S2 (D) data quote to support **;**

S3 (E) ref. (far) fewer stomata (mm^{-2}) so less water (vapour) lost **;**

AVP **;** e.g. ref. ABA and stomatal closure **(T)**
less water (vapour) leaves plant as only cuticular transpiration possible **(T)**
ref. to higher rate for apple (dry days) and suggestion that stomata are larger [max 4]

(b) (i decreased / lower, rate during night **;** ora
stomata closed at night **;** ora
further detail **;** e.g. closed to prevent water loss
closed as no photosynthesis
no light for photosynthesis
open (during day) for, gas exchange / CO_2 in [3]

(iii) peach / *Prunus persica / P. persica* **;** [1]

(c) (i) (repairing damaged DNA) reduces risk of cancer **;** **A** prevents

further detail **;** *in context of reducing risk*
e.g. because tobacco smoke contains mutagens
because tobacco smoke contains carcinogens
ref. to mutation (as result of damaged DNA) [2]

(ii) reduces risk of, <u>chronic</u> bronchitis / emphysema / COPD **;**

further detail **;** *in context of reducing risk*
e.g. (reducing inflammation)
reduces risk of infection
prevents excess mucus production **R** if linked to emphysema
prevents alveolar wall breakdown **R** if linked to bronchitis
no / less, scar tissue forms [2]

[Total: 16]