Markscheme

May 2018

Nature of Science

Standard level

Paper 1

14 pages

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Section A

Question			Answers	Notes	Total	
1.			C		1.	1
2.			B		2.	1
3.			D		3.	1
4.			A		4.	1
5.			A		5.	1

Question			Answers	Notes	Total
6.	**a**		$1 \times (3 \times 10^8)^2$ ✓ 9×10^{16} J **OR** $9 \times 10^{16}\,\text{kgm}^2\text{s}^{-2}$ ✓	*Units required for M2.* *Accept answers with other correct units.*	**2**
6.	**b**		the process where the nucleus «of an atom» is split into several smaller fragments/atoms/particles «and neutrons» ✓ chain reaction ✓ the final total mass is less than the initial mass **OR** the difference in mass/mass deficit/mass amount of energy appears as energy ✓		**2 max**
6.	**c**		energy density in uranium-235/U-235 much greater than in fossil fuels ✓	*OWTTE*	**1**

7.			understanding of scientific processes for use of raw materials/invention of new materials required ✓ some very rare/important materials required for high tech products ✓ availability/accessibility/geographic location/some raw materials are rare ✓ economic such as supply and demand/cost **OR** political situation/ethical issues, *eg* wars ✓ energy cost for each material/economic factors ✓ purity/concentration of the ores ✓ environmental impact, *eg* carbon footprint, recycling, pollution ✓ sustainability ✓		**3 max**

Question			Answers	Notes	Total
8.	a		Any one of: HIV, SARS, Ebola, bird/avian influenza, MERS/camel influenza, malaria, swine flu, cowpox, rabies ✓	Accept any other correct human disease. Accept "AIDS" for "HIV".	**1**
8.	b		<table><tr><th>Correlative relationship</th><th>Causal relationship</th></tr><tr><td>similar pattern or trend between the disease and other variable</td><td>show a direct cause and effect evidence ✓</td></tr><tr><td>eg Ebola cases increased with increased consumption of bush meat</td><td>eg eating infected bush meat transfers the Ebola pathogen into humans and causes the disease ✓</td></tr><tr><td>named disease will continue to spread if correlative factors are removed</td><td>eradication of the cause stops the named disease from spreading ✓</td></tr></table>	Award **[1 max]** if disease not named. Each row is [1] mark. Need both parts in a row for mark.	**2 max**
8.	c		<table><tr><td>poverty factor ✓</td><td>name of disease ✓</td></tr><tr><td colspan="2">Examples could include:</td></tr><tr><td>poor/lack of sanitation ✓</td><td>cholera/typhoid ✓</td></tr><tr><td>overcrowded/poor living conditions ✓</td><td>tuberculosis/TB ✓</td></tr><tr><td>unsafe sex/lack of education/access to condoms ✓</td><td>AIDS ✓</td></tr><tr><td>limited medical access contributes to progression from HIV infection to ✓</td><td>AIDS ✓</td></tr><tr><td>lack of protection against mosquitoes ✓</td><td>malaria ✓</td></tr></table>	Accept "HIV" for "AIDS".	**2 max**

(continued…)

(Question 8 continued)

8.	d						

Preventative treatments	Curative treatments
may have side effects ✓	
same aim to improve health ✓	
both based on scientific understanding/science ✓	
may influence life style ✓	
maintains health/prevents disease	cures the disease ✓
reduces health costs	costs to health system/society may be higher ✓
reduces the spread/incidence of the disease	does not reduce the spread/incidence of the disease ✓
before infection	after infection ✓

Each row is [1] mark.

Need to have one comparison and one difference for [2] marks.

Need both parts in a row for [1] mark.

2 max

Section B

	Question		Answers	Notes	Total
9.	**a**		attraction to/gravity/pull of Earth/like the moon ✓ they do not fall to Earth because of curvature of Earth's surface/Earth is a sphere ✓ «Newton's Law of gravitation states that» attraction between two masses/attraction between mass of satellite and mass of the Earth/centripetal force ✓ Newton's first law/inertia ✓		**2 max**
9.	**b**		takes 24 hours to complete one orbit at this altitude **OR** appears stationary ✓ follows the rotation of the Earth **OR** satellite is located at the same point above the Earth all the time ✓ that height/altitude is the only one that gives the required speed ✓ send signals from one country to another "in real time" ✓ allows a large area to be covered **OR** $\frac{1}{3}$ of Earth's surface covered ✓		**2 max**

(continued…)

(Question 9 continued)

9.	c		transmits signals «consistently» to the same place ✓ fixed antennae on Earth/no need for antennae to track satellite ✓ signals reach a large area on Earth/signals have a big footprint ✓		**2 max**
9.	d		weather satellites ✓ telephone ✓ internet **OR** digital radio ✓ monitoring/listening to communications ✓	*Accept any other correct answer.*	**2 max**
9.	e		large costs/waste of money **OR** better use for the money ✓ spying on individuals/companies/governments ✓ spy cameras can take detailed photos ✓ satellites can eavesdrop on telephone/internet communications ✓ satellites pass over airspace of other/many countries' space ✓ broadcasting TV/radio to countries without permission ✓ who is responsible for Space junk/thousands of disused satellites/bits of satellites orbiting about that can cause danger to human piloted spacecraft ✓ pollution/«rocket» launch emissions ✓		**3 max**

(continued…)

(Question 9 continued)

| 9. | f | | **Impact:**

light produced from electricity/electricity produced mainly from fossil fuels
OR
electricity production causes pollution ✓
release CO_2 which is a greenhouse gas/contributes to global warming/climate change ✓
«waste» heat produced ✓
light pollution
OR
stars cannot be seen ✓
impact on ecosystems/nocturnal animals/populations ✓
Reducing impact:
regulations «national governments/international» on power use and time ✓
reduce use of electricity by using more efficient bulbs/LEDs/turn lights off ✓
use renewable sources of energy such as wind/solar/geothermal so less fossil fuels burned ✓ | *Award **[2 max]** unless both parts addressed.* | **3 max** |
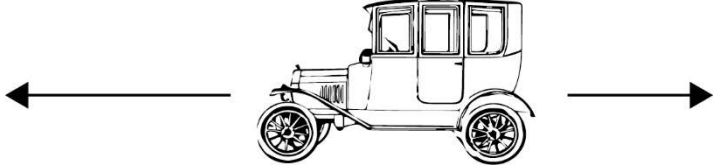
Question			Answers	Notes	Total
10	**a**		«optical» telescope ✓ diffraction grating/spectrometer ✓		**2**
10	**b**		a spectrum is like a finger print/barcode ***OR*** «the spectrum from the star» is a mixture of different elements ✓ the spectrum from the star is compared with the spectra from known elements on Earth ✓ overlapping spectra identify the element ✓		**2 max**
10	**c**		hydrogen and helium ✓		**1**
10	**d**		moving away from the Earth ✓ universe is expanding ✓ red shift is different in size for all four spectra indicating they are all travelling at different speeds/velocities ***OR*** the furthest ones are travelling the fastest ✓		**3 max**

Question			Answers	Notes	Total
11	a		prevents «some» infectious diseases **OR** cures bacterial diseases ✓ less feed required/promotes growth ✓ less time for full growth saves money ✓ buildup of antibiotic resistance in bacteria ✓ antibiotic enters human food chain ✓		**3 max**
11	b		less reliance/demand on animal products **OR** more reliance/demand on vegetables ✓ some animal feedstuff may be eaten directly by humans ✓ more «varied» vegetarian products available ✓ less water/land used for meat production/more water/land available ✓ transfer of land use not always possible ✓ change from meat to vegetable production ✓ eat lower on food chain/more efficiently ✓ more food available ✓ technology developments for more «artificial» meat-like products ✓		**3 max**

(Question 11 continued)

	Question		Answers	Notes	Total
11	**c**		large amount wasted «20%-30%» ✓ food lost during planting/harvesting/storage/transport ✓ food wasted at retail/consumption stage ✓ more efficient food system would reduce losses and increase total food available ✓ poverty and not enough food in some places ***OR*** poor distribution ✓		**2 max**

	Question		Answers	Notes	Total
12	a		forces both horizontal and opposite ✓ the forward arrow is longer than the backwards arrow ✓ 		2
12	b		reduce drag/air flow ✓ increase streamlining/make more aerodynamic ✓		1 max
12	c			Each row is [1] mark. Need to include one comparison and one difference to get [2] marks. Need both parts in a row for [1] mark.	2 max

Table for 12 c:

Internal combustion	All-electric
heats up atmosphere/pollution ✓	
burns fossil fuel that emits CO_2 contributing to enhanced global warming	CO_2 emissions depend on whether electricity is produced from fossil fuels, renewable sources or a mixture ✓
harmful chemical emissions	no chemical emissions from car itself ✓
noisy	less noise ✓
highly polluting	less total pollution «in production and use» ✓

(continued…)

(Question 12 continued)

	Question		Answers	Notes	Total
12	d	i	energy from fossil fuels used to build the factory/CO_2 emissions ✓ energy from fossil fuels used to build the solar cells/CO_2 emissions ✓ water usage/waste ✓ displaces wild life ✓;		**1 max**
12	d	ii	energy from fossil fuels used to transport the batteries/materials to build the batteries ✓ energy from fossil fuels to mine for and refine lithium ✓ lithium-ion batteries difficult to dispose safely «because lithium is toxic/flammable» ✓		**1 max**
12	e		use electric cars powered from renewable sources ✓ use hydrogen fuel cell car ✓ make internal combustion engine more efficient/less emissions ✓ ban internal combustion engine ✓ use car less/use a bike/walk ✓ share own car/use taxis/rent a car/car sharing schemes/public transport ✓ work at home/teleworking ***OR*** live closer to work ✓ speed limits ***OR*** drive slower ✓ open windows instead of air conditioning ✓		**3 max**