

Name of the Student: _____

Max. Marks : 24 Marks

Time : 24 Minutes

Mark Schemes

Q1.

- (a) **M1** reaction of nitrogen/ N_2 and oxygen/ O_2 from the air
Must be at least one reference to air.
NOT reference to nitrogen/oxygen from the fuel.
Allow equation plus a reference to the air.
Allow combustion of nitrogen plus reference to the air.
NOT M1 if reference to reaction taking place in the catalytic converter.
 1
- M2** at high temperatures
Allow high energy/heat or very hot.
Allow heat/energy in the engine provides Ea
IGNORE references to pressure/spark
 1
- (b) Formation of acid rain / causes respiratory problems
Allow (contributes to) ground level ozone / (photochemical) smog / toxic / poisonous
Allow makes water acidic / reacts with water to form nitric acid / (NO_x gases are) acidic
IGNORE greenhouse gases / global warming / damages ozone layer
IGNORE vague answers such as 'harmful to environment'/polluting/harmful
NOT reference to pH rising
 1
- (c) **M1** $NO_2 = (+)4$ $NH_3 = -3$ $N_2 = 0$
 1
- M2** $3NO_2 + 4NH_3 \rightarrow 7/2N_2 + 6H_2O$
ALLOW multiples/fractions
($6NO_2 + 8NH_3 \rightarrow 7N_2 + 12H_2O$ OR
 $1\frac{1}{2}NO_2 + 2NH_3 \rightarrow 1\frac{3}{4}N_2 + 3H_2O$)
 1
- (d) **M1** Catalyst in different phase/state (to reactants)
*NOT (catalyst in different phase/state to) products allow catalyst in different phase/state to reactants **and** products*
 1
- M2** Speeds up reaction without being used up
ALLOW speeds up the reaction by (providing alternative route for

reaction and) lowering E_a
NOT does not take part in the reaction

1

(e) incomplete combustion

ignore equations

ALLOW description of incomplete combustion (e.g. not enough oxygen)

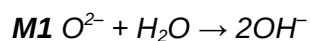
Allow O_2 but NOT O for oxygen

1

[8]

Q2.

- (a) **M1** (oxide ions react with water to) form/produce hydroxide **ions**



Ignore all non-ionic equations

1

- M2** sodium hydroxide more soluble than magnesium hydroxide

M2 *ideas that more sodium hydroxide dissolves / dissociates*

Allow sodium oxide more soluble / dissociates more than magnesium oxide NOT 'molecules' or 'atoms'

1

- (b) $P_4O_{10} + 6H_2O \rightarrow 4H_3PO_4$

Allow multiples and fractions

Allow ionic products

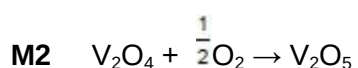
NOT P_2O_5

1

- (c) **M1** $V_2O_5 + SO_2 \rightarrow V_2O_4 + SO_3$

Allow 1 mark if both equations correct, but in wrong order

1



ALLOW multiples

1

[5]

Q3.

- (a) **M1** absorb (some) wavelengths/frequencies/colours/energies of (visible) light
*wavelengths/frequencies/colours/energies of (visible) light only
needed once in the answer
Allow absorption of a photon of light NOT uv light* 1
- M2** to promote/excite electrons in d-orbitals
*Allow d-subshell / d-energy level / d-electrons Reference to 'd' can
appear anywhere in the answer* 1
- M3** remaining/complementary wavelengths/frequencies/colours/energies of
(visible) light reflected/transmitted (to give colour seen)
NOT emissions/emitting or 'give out' 1
- (b) **M1** $(\Delta)E = \frac{hc}{\lambda}$
Allow in two stages / expressed in words 1
- M2** 490×10^{-9}
M2 for conversion 1
- M3** $= (6.63 \times 10^{-34} \times \frac{3.00 \times 10^8}{490 \times 10^{-9}}) = 4.06 \times 10^{-19} \text{ J}$
*Correct answer scores 3 marks
 4.06×10^{-19} scores 2 marks (no M2)
 $9.75 \times 10^{-32} = 1 \text{ mark (M2)}$* 1
- (c) **M1** **measure** absorbance for (a range of) known concentrations
Insist on description of taking measurements 1
- M2** plot graph absorbance v concentration
Allow concentration v absorbance 1
- M3** read value of concentration for the measured absorbance from this graph
*If no M1, must mention both variables
Need to describe HOW they use the graph* 1
- (d) **M1** amount of iron in each tablet = $4.66 \times 10^{-3} \times \frac{250}{1000}$ (= 0.001165 mol) 1
- M2** mass of iron in each tablet = $4.66 \times 10^{-3} \times \frac{250}{1000} \times 55.8 = 0.0650 \text{ g} = 65 \text{ mg}$
*Correct answer = 2 marks
Allow M2 for (M1 x 55.8 x 1000)* 1

[11]