

Examiners' Report on Paper B (Chemistry)

(Reference to the papers refer to the English version as published in this *Compendium*: page A line B are cited as A/B)

The application as presented to the candidates related to a catalyst comprising vanadium pentoxide and rutile titanium dioxide having a specific vanadium pentoxide content and BET specific surface area and to a process for oxidising hydrocarbons in the presence of said catalyst.

Three processes for making such catalysts were given in the application:

- (1) A process comprising contacting a rutile titanium dioxide support with a gaseous vanadium compound;
- (2) a method comprising the precipitation of vanadium oxide from a V(IV)-solution in the presence of a titanium dioxide hydrogel;
- (3) the co-precipitation of vanadium and titanium oxides from the mixture of their aqueous solutions.

Processes (1) and (2) were disclosed in document **DI**. Document **DII** described a process of type (3) where the precipitate was dried, oxidised and calcined at a temperature of at least 250 °C. The only example of **DII** disclosed a calcination temperature of 350 °C.

Most of the candidates had realised that examples 5 to 7 of the application presented to them showed that a catalyst obtainable by process (3) and calcined at temperatures of from 500 °C to 600 °C showed an improved selectivity for the oxidation of butenes to acetic acid as compared to those calcined at higher or lower temperatures.

It should have been evident that said range of from 500 to 600 °C was only disclosed for the catalysts prepared by process (3).

Independent claims were expected directed to:

- a process for making the catalyst by co-precipitating the Ti- and V-oxides from a mixture of the aqueous solutions (as outlined in 80/12 - 17), followed by drying, oxidising and calcining at a temperature of from 500 to 600 °C,
- a claim to the catalyst obtainable by this process, and
- a claim to a process for oxidising hydrocarbons by means of said catalyst.

Some candidates restricted the claim to the preferred process features given at 80/29 - 45 of the paper. They had not realised that a more general basis for the process claim was given on *page 80, para 3* [in the original paper: top of page 3]. These candidates did not gain all the marks available.

The scope of the application was clearly limited to catalysts having a vanadium pentoxide content of from 1 to 50 % and a specific surface area of 5 to 100 m²/g. Candidates who did not include this feature in their independent claims (including process claims) lost marks.

In their **arguments** several candidates did not present arguments as to why the catalyst as such (claimed in a product-by-process claim) was novel and inventive. A good argument for novelty was that calcination effects a physical or chemical change of the catalyst (see 8/8 - 10) and that the difference in selectivity of the catalysts claimed was apparently due to such a difference in structure of the catalyst.

The expected claims were directed to a selection of a certain temperature range (i.e. 500 to 600 °C) from the disclosure of **DII** (calcination at temperatures above 250 °C with 350 °C being disclosed in the example). It was expected that the candidates gave reasons why this selection was novel (see T 279/89). The candidates were also expected to argue, using the problem-solution approach, that this selection was inventive in view of both document **DII** alone as well as a combination of documents **DI** and **DII**.

A number of candidates presented claims in which the range of calcination temperatures was 500 °C to 700 °C. It was possible to present the plausible argument that this range of calcination temperatures represented a novel and inventive selection due to the fact that in this temperature range there was a particularly low selectivity to the unwanted oxides of carbon. These candidates however lost marks since the application indicated that acetic acid was the desired product and thus a high selectivity to acetic acid was more important than a low selectivity to oxides of carbon.

EXAMINATION COMMITTEE I

Candidate No.

StudentBounty.com

Paper B (Chemistry) 2000 - Schedule of marks

Category	Maximum possible	Marks awarded		Marking by further examiners if any	
		Marker	Marker	Marker	Marker
Claims	50				
Argumentation	50				
Total	100				

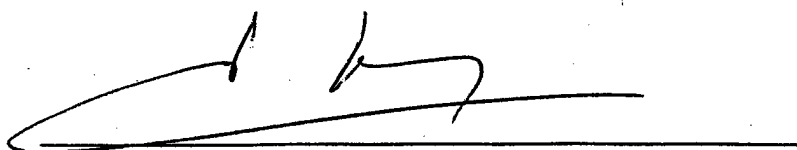
Sub-Committee for Chemistry agrees onmarks and recommends the following grade to the Examination Board:

PASS
(50-100)

FAIL
(0-49)

COMPENSABLE FAIL
(45-49, in case the candidate sits the examination for the first time)

Berlin, 18 August 2000



J. Combeau - Chairman of Examination Committee I