



<b>Abbreviations, annotations and conventions used in the Mark Scheme</b>	/ = alternative and acceptable answers for the same marking point : = separates marking points NOT = answers which are not worthy of credit () = words which are not essential to gain credit <u>      </u> = (underlining) key words which <u>must</u> be used to gain credit ecf = error carried forward AW = alternative wording ora = or reverse argument
---------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Question	Expected answers	Marks
1 (a)	  ✓ 1, 2 or 3 p orbitals are OK	[2]
(b)	d orbital 2 ✓ p sub-shell 6 ✓ 3rd shell 18 ✓	[3]
(c) (i) (ii)	 2s and 2p labels ✓ Ignore any superscripted numbers. 8 electrons in correct levels with arrows correctly shown ✓	[2]
(d) (i)	Energy change when each atom in 1 mole ✓ of gaseous atoms ✓ loses an electron ✓ (to form 1 mole of gaseous 1+ ions).	[3]
(ii)	$O^{2+}(g) \longrightarrow O^{3+}(g) + e^{-}$ ✓✓ 1 mark for correct species; 1 mark for state symbols No charge required on electron. Ignore (g) on e	[2]

## F321 Past Papers

**Edwin Anderson Alderman, Charles  
Alphonso Smith**

## F321 Past Papers:

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**1591-April 1592** Great Britain. Public Record Office, 1980 **General Topology and Modern Analysis** Louis F. McAuley, Malempati Madhusudana Rao, 1981 **Journal of Engineering for Power** , 1960 **Library of Southern Literature: Biographical dictionary of authors** Edwin Anderson Alderman, Charles Alphonso Smith, 1910 **Dictionary Catalog of the Department Library** United States. Department of the Interior. Library, 1969 **Transactions of the**

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web hydrogen production processes thermochemical processes some thermal processes use the energy in various resources such as natural gas coal or electrolytic processes electrolyzers use electricity to split water into hydrogen and oxygen this technology is well direct solar water splitting

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web hydrogen fuel basics thermal processes thermal processes for hydrogen production typically involve steam reforming a high temperature electrolytic processes water can be separated into oxygen and hydrogen through a process called electrolysis solar driven processes solar driven processes use