Pharm-10B7 List the physical properties of oxygen. Discuss the potential adverse effects associated with oxygen administration.

**Background**
Oxygen is a gas present in the atmosphere (21%) and is essential for normal cellular function. \( \text{O}_2 \) is also used as a medical gas, e.g. in the treatment of hypoxaemia.
Molecular formula \( \text{O}_2 \)
Preparation by:
- fractional distillation (large scale, commercial production) – (conc. 100%)
- \( \text{O}_2 \) concentrator using zeolite mesh (small scale, rural) – (conc. ~97%)

**Physical properties**
Clear, colourless, odourless
Molecular weight 32
Boiling point -182 \( ^\circ \text{C} \)
Critical temperature -119 \( ^\circ \text{C} \), pressure 50 bar
Paramagnetic

**Potential adverse effects**

1. Free radical formation
   Occurs usually when \( P_{\text{O}_2} \geq 200 \text{kPa} \)
   - CNS – anxiety, nausea and seizures
   - Lung – lipid peroxidation of capillary membrane → atelectasis

2. \( \text{O}_2 \) absorption atelectasis
   Areas of the lung with low V/Q → absorbs high \( F_{\text{O}_2} \) → volume unable to be replaced with adequate ventilation (and \( \text{N}_2 \) not present as splint) → atelectasis

3. \( \downarrow \) Hypoxic drive in \( \text{CO}_2 \) retainers
   Normal subjects have mild depression of respiratory drive with hyperoxia (respiratory drive maintained by \( P_{\text{aCO}_2} \))

   Patients with chronic hypercapnia depend on hypoxic drive to maintain respiratory drive
   ∴ small increase in \( P_{\text{aO}_2} \) may significantly depress respiratory drive

4. Retrolental fibroplasia (in neonates)
   High \( P_{\text{aO}_2} (> 140 \text{mmHg}) \) in neonates → vasoconstriction of developing retinal blood vessels → vessel growth halted → when hyperoxic environment removed → abnormal proliferation of blood vessels → retrolental fibroplasia → blindness

   Risk factors: prematurity, low birth weight, high \( P_{\text{aO}_2} \)

5. Promotes combustion
   May cause + propagate fire

6. Increased mortality – debatable
   Some recent evidence to suggest that hyperoxia during cardiac arrest may increase mortality
   Possible mechanism via cerebral and coronary vasoconstriction ± steal
**Examiner’s comments** - 67% of candidates passed this question.

The question was similar to that asked in a previous exam, and clearly some candidates used this to their advantage.

Generous margins were accepted for some of the numerical physical properties of oxygen, but marks could not be awarded for significant disparities. Although not specifically asked for on this occasion, marks were awarded for descriptions of how oxygen is manufactured where this was adequately linked to the relevant physical property.

The adverse effects portion of the question was generally well done, but insufficient to compensate for the absence of an answer for the first half of the question.