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OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

Memorandum

TO : AA/Director

DATE: January 25, 1968

In reply refer to:
DA-68-46 19/2b

FROM : DA/Director of Medical Research and Operations

SUBJECT: Senior Flammability Review Board Meeting, January 13, 1968

We do not concur in the stated finding of the Board that a 60% oxygen, 40% nitrogen atmosphere is acceptable from a crew physiological standpoint.

While it is true that a 60% oxygen, 40% nitrogen atmosphere at 5.6 psi should result in a cabin atmosphere physiologically equivalent to sea level conditions, this will not be the case in a spacecraft launched with a 60% oxygen, 40% nitrogen atmosphere to which no oxygen is added except by normal operation of the cabin regulator. Oxygen will be metabolized by the crew at a much greater rate than will nitrogen be leaking from the spacecraft. Assuming a case in which the cabin relief valve seats at 6 psi and the cabin regulator does not begin adding oxygen until 4.8 psi, the cabin atmosphere would then consist of approximately 49% oxygen. This is physiologically equivalent to a 12,000 foot altitude in air. It would then take approximately 50 hours at the nominal cabin leak rate for the cabin regulator to enrich the mixture to a sea level equivalent.

For a variety of reasons (see attached background paper) we believe that our requirement for a sea level equivalent cabin atmosphere is sound. I am certain that if we were to fly Apollo with a 60% oxygen, 40% nitrogen atmosphere which was not enriched after reaching orbit, we would have serious objections from the scientific community on technical as well as political grounds.

Therefore, it is our recommendation that the breathing mixture available to the crew should not result in arterial oxygen saturations lower than those equivalent to sea level conditions for any prolonged period of time nor for any

critical phase of the mission. If it appears from the flammability standpoint to be desirable to use a 60-40 mixture for launch, then it should be enriched in orbit. If operational constraints imposed by enrichment outweigh flammability considerations, then the mixture used at launch should be one which would never result in an oxygen concentration lower than 70% in flight.

Charles A. Berry M.D.

Charles A. Berry, M. D.

Enclosure

cc:
See attached list

DA/March 4, 1968

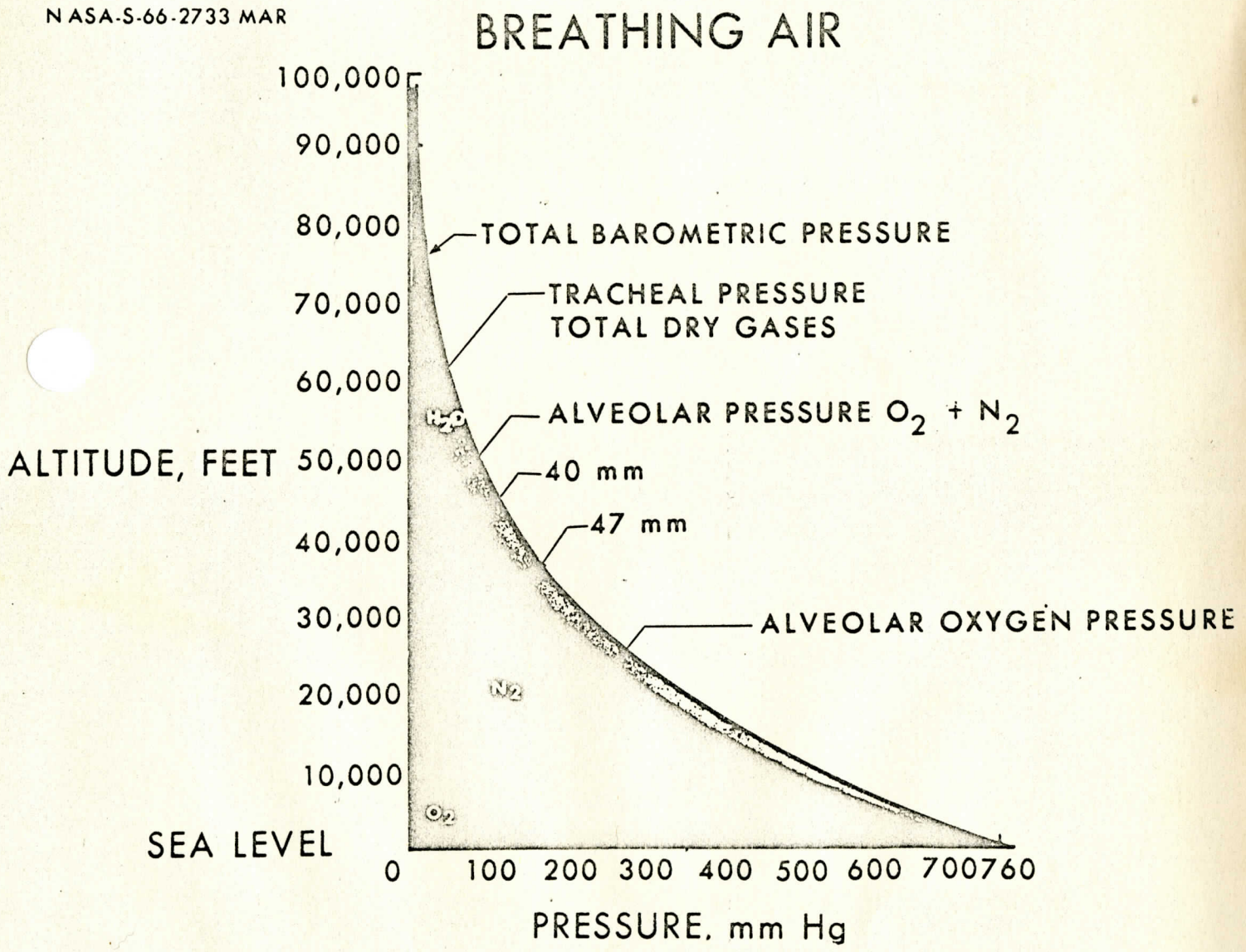
PRINCIPAL PHYSIOLOGICAL CONSIDERATIONS

HYPOXIA - A REDUCED AMOUNT OF OXYGEN AVAILABLE TO THE BODY'S CELLS COMPARED TO THAT PROVIDED AT SEA LEVEL.

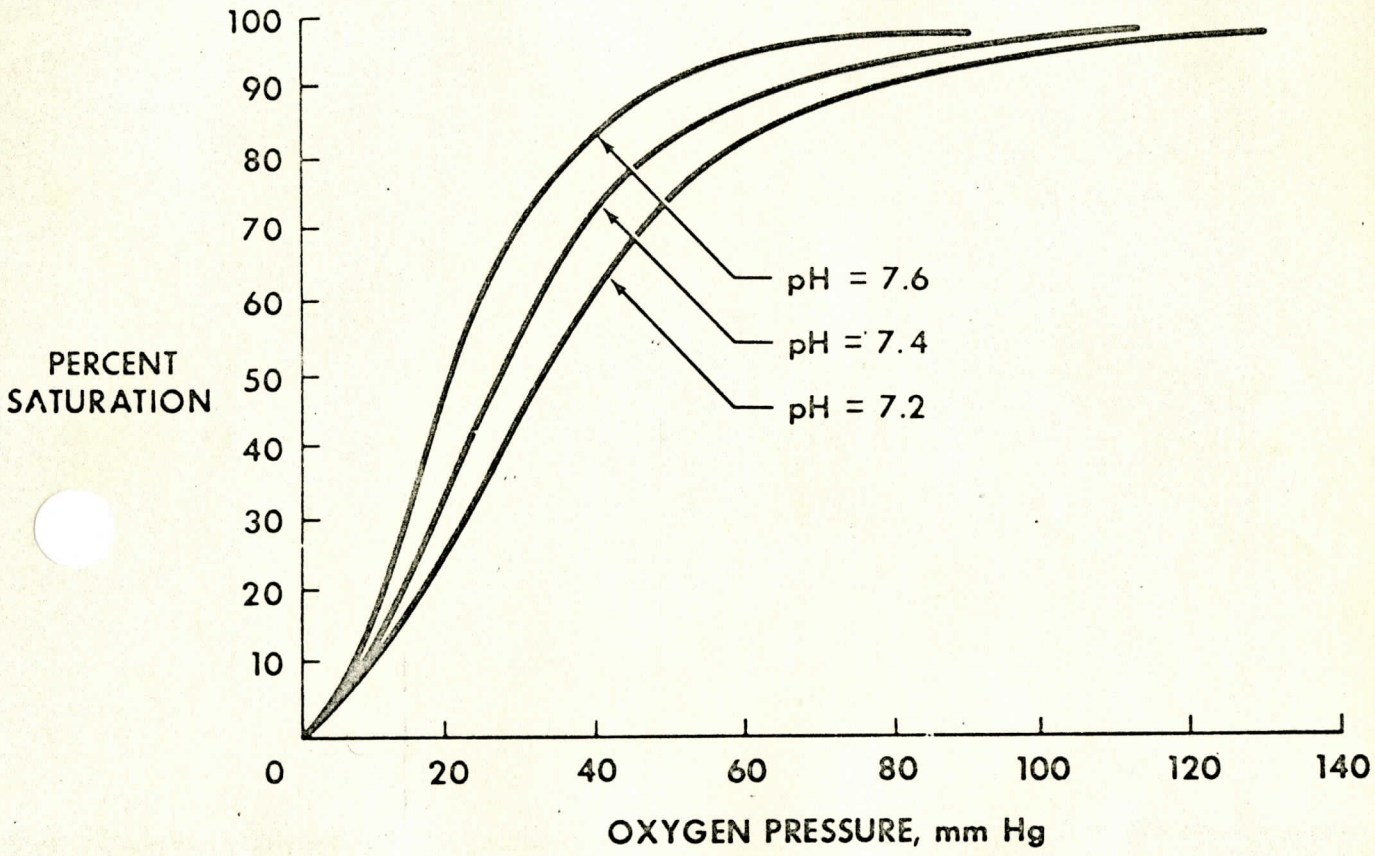
HYPEROXIA - AN INCREASED AMOUNT OF OXYGEN AVAILABLE TO THE BODY'S CELLS COMPARED TO THAT PROVIDED AT SEA LEVEL.

DYSBARISM - THE SYMPTOMS RESULTING FROM A DECREASE IN TOTAL ATMOSPHERE PRESSURE.

NASA-S-66-2733 MAR

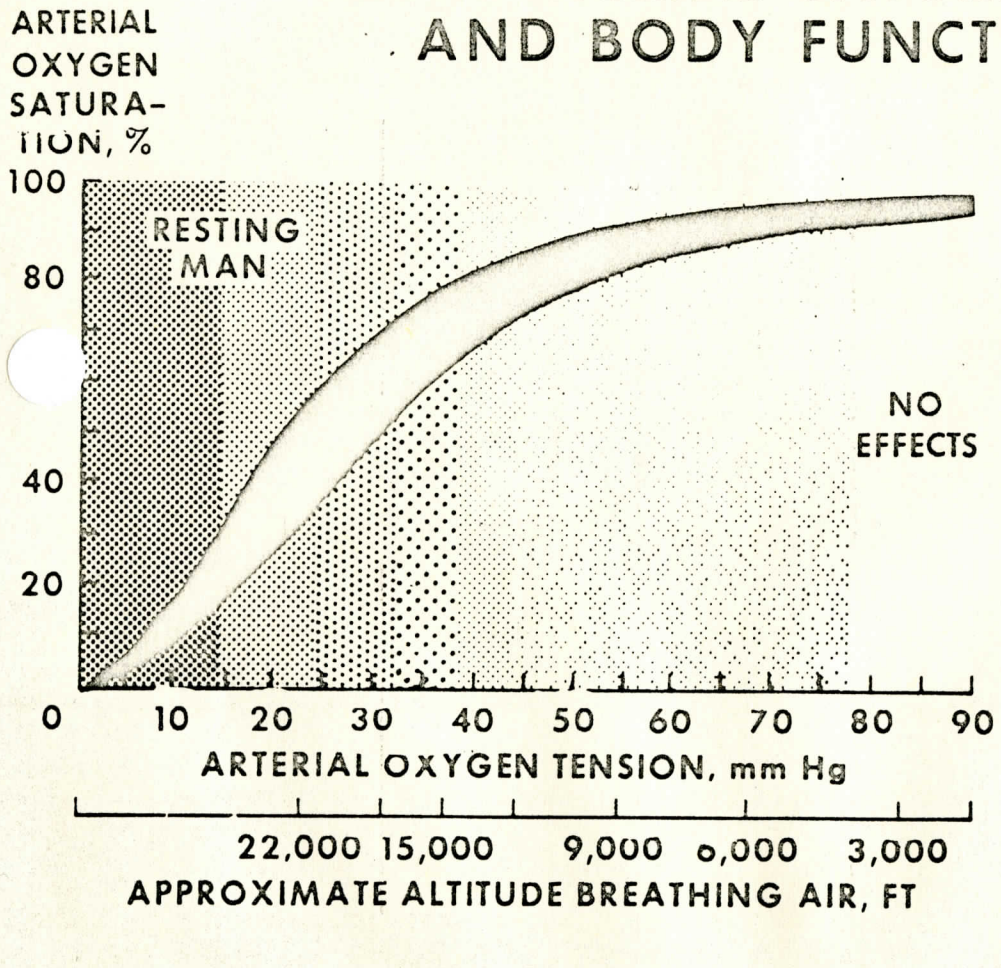


OXYGEN DISSOCIATION CURVE OF THE BLOOD FOR DIFFERENT pH CONDITIONS



NASA-S-68-115

GENERAL EFFECTS OF HYPOXIA ON ARTERIAL SATURATION AND BODY FUNCTION



UNCONSCIOUSNESS IN SECONDS

UNCONSCIOUSNESS IN MINUTES

UNCONSCIOUSNESS IN HOURS

ALTERED JUDGMENT IMPAIRED COORDINATION

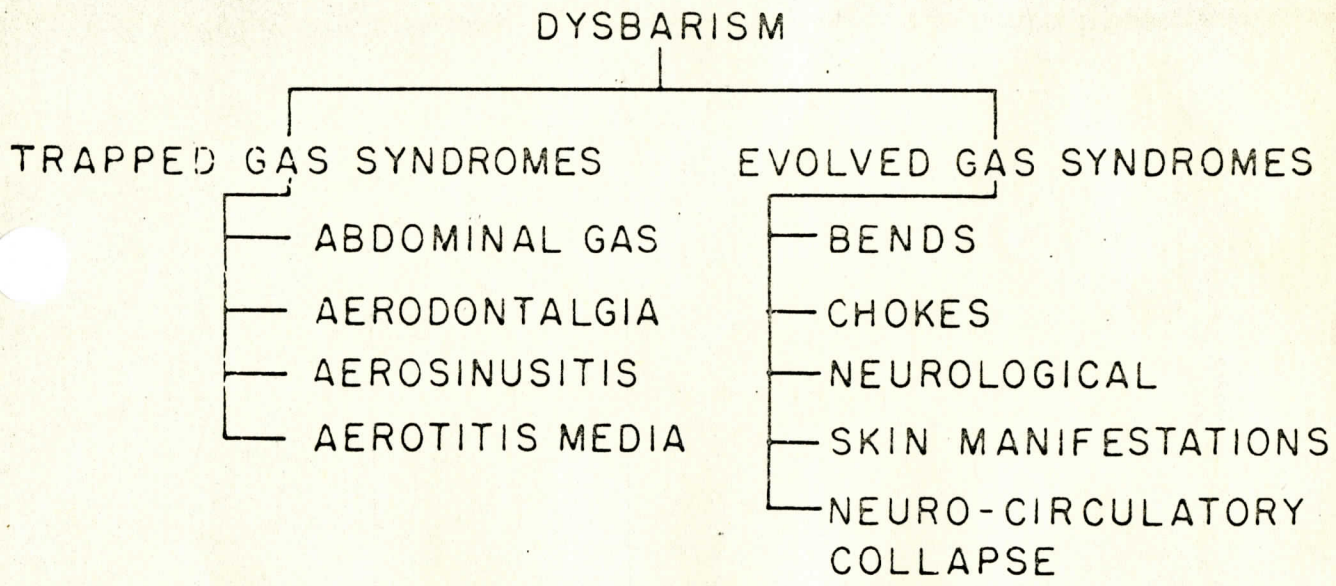
IMPAIRED RECENT MEMORY AND CALCULATION

DECREASED NIGHT (SCOTOPIC) VISUAL SENSITIVITY

NO EFFECTS

RANGE OF OXYGEN SATURATION

THE DYSBARISM FAMILY TREE



NASA-S-68-114

CRITICAL TISSUE NITROGEN ELIMINATION CURVE

TISSUE 1/2 TIME 360 MINUTES