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Pawam

72

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[Question Paper : 1-10] [Open Text Material: 11-28]

संकलित परीक्षा - II

SUMMATIVE ASSESSMENT - II (2014-15)

SCIENCE / विज्ञान

Class - IX / कक्षा - IX

निर्धारित समय : 3½ घण्टे

Time allowed: 3½ hours

अधिकतम अंक : 90

Maximum Marks: 90

सामान्य निर्देश :

- (i) इस प्रश्न पत्र को तीन भागों, भाग-अ, भाग-ब और भाग-स में बांटा गया है। आपको तीनों भागों के प्रश्नों के उत्तर लिखने हैं।
- (ii) सभी प्रश्न अनिवार्य हैं।
- (iii) पूरे प्रश्न पत्र में किसी प्रश्न में कोई चयन प्राप्त नहीं है।
- (iv) आपको भाग-अ, भाग-ब और भाग-स के सभी प्रश्नों के उत्तर पृथक-पृथक लिखने होंगे।
- (v) भाग-अ के प्रश्न संख्या 1 से 3 के प्रश्न एक-एक अंक के हैं। इनके उत्तर एक शब्द अथवा एक वाक्य में दें।
- (vi) भाग-अ के प्रश्न संख्या 4 व 5 प्रश्न दो-दो अंकों के हैं। इनके उत्तर लगभग 30 शब्दों में देने हैं।
- (vii) भाग-अ के प्रश्न संख्या 6 से 16 के प्रश्न तीन-तीन अंकों के हैं। इनके उत्तर लगभग 50 शब्दों में देने हैं।
- (viii) भाग-अ के प्रश्न संख्या 17 से 21 के प्रश्न पाँच-पाँच अंकों के हैं। इनके उत्तर लगभग 70 शब्दों में देने हैं।
- (ix) भाग- ब के तीन प्रश्न, प्रश्न संख्या 22 से 24 मुक्तपाठ पर आधारित हैं। इन में प्रश्न संख्या 22 के 2 अंक, प्रश्न संख्या 23 के 3 अंक तथा 24 के 5 अंक हैं।
- (x) भाग-स के प्रश्न संख्या 25 से 33 के प्रश्न प्रयोगात्मक कौशल पर आधारित बहुविकल्पी प्रश्न हैं। प्रत्येक प्रश्न एक अंक का है। दिए गये चार विकल्पों में से आपको सबसे उपयुक्त विकल्प चुनना है।
- (xi) भाग-स के प्रश्न संख्या 34 से 36 के प्रश्न प्रयोगात्मक कौशल पर आधारित दो-दो अंकों के प्रश्न हैं। इनके उत्तर लगभग 30 शब्दों में देने हैं।

General Instructions :

- (i) The question paper comprises three Sections, A, B and C. You are to attempt all the sections.
- (ii) All questions are compulsory.
- (iii) There is no choice in any of the questions.
- (iv) All questions of Section-A, Section-B and Section-C are to be attempted separately.
- (v) Question numbers 1 to 3 in Section-A are one mark questions. These are to be answered in one word or in one sentence.
- (vi) Question numbers 4 and 5 in Section-A are two marks questions. These are to be answered in about 30 words each.
- (vii) Question numbers 6 to 16 in Section-A are three marks questions. These are to be answered in about 50 words each.

- (viii) Question numbers 17 to 21 in Section-A are five marks questions. These are to be answered in about 70 words each.
- (ix) Section B has 3 OTBA questions. Question number 22 is two marks, Question number 23 is three marks and Question number 24 is five marks question.
- (x) Question numbers 25 to 33 in Section-C are multiple choice questions based on practical skills. Each question is a one mark question. You are to select one most appropriate response out of the four provided to you.
- (xi) Question numbers 34 to 36 in section C are two marks questions based on practical skills. These are to be answered in about 30 words each.

	भाग-अ / SECTION-A	
1	एक द्विपरमाणुक तथा एक चतुर्परमाणुक तत्वों के नाम लिखिए। Write names of one diatomic and one tetra atomic elements.	1
2	निम्न के प्रतीक लिखिये - अमोनियम आयन, कैल्शियम आयन Write the symbol for - Ammonium ion, Calcium ion.	1
3	जिम्नोस्पर्म क्या हैं? इनका एक उदाहरण दीजिए। What are gymnosperms ? Give one example.	1
4	2 किलोग्राम द्रव्यमान की एक गेंद जिसमें 4 J गतिज ऊर्जा विद्यमान है, की चाल परिकलित कीजिए। Compute the speed of 2kg ball having kinetic energy of 4 J.	2
5	आपेक्षिक घनत्व की परिभाषा लिखिए। दिया गया है कि चाँदी का आपेक्षिक घनत्व 10.3 है। चाँदी का घनत्व ज्ञात कीजिए। Define relative density. What is the density of silver given that its relative density is 10.3 ?	2
6	(a) नीचे दी गई स्पीशीज में से किनमें 18 इलेक्ट्रॉन हैं? $\text{Ca}^{+2}, \text{K}^+, \text{Na}, \text{Cl}^-, \text{Ar}$ (b) किसी तत्व के सभी समस्थानिकों के रासायनिक गुण एक समान होते हैं। कारण लिखिए। (a) Which of the following species have 18 electrons? $\text{Ca}^{+2}, \text{K}^+, \text{Na}, \text{Cl}^-, \text{Ar}$ (b) Chemical properties of all the isotopes of an element are similar. State reason.	3
7	(a) H_2O के एक अणु का आण्विक द्रव्यमान परिकलित कीजिए। (b) 9 ग्राम H_2O में विद्यमान अणुओं की संख्या ज्ञात कीजिए।	3

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	(परमाणु द्रव्यमान $H=1\text{ u}$, $O=16\text{ u}$) (a) Calculate the molecular mass of a molecule of H_2O . (b) Find the number of molecules present in 9 g of H_2O ? (Atomic mass $H=1\text{ u}$, $O=16\text{ u}$)	
8	(a) नाइट्रोजन, ऑक्सीजन तथा आर्गन के संयोजकता कोशों में क्रमशः कितने इलेक्ट्रॉन विद्यमान हैं? (b) किसी परमाणु के नाभिक में 5 प्रोटॉन तथा 6 न्यूट्रॉन हैं। परमाणु की परमाणु संख्या, द्रव्यमान संख्या तथा इलेक्ट्रॉनिक विन्यास क्या है? (a) How many electrons are present in the valence shells of nitrogen, oxygen and argon respectively? (b) Nucleus of an atom has 5 protons and 6 neutrons. What is the atomic number, mass number and electronic configuration of the atom?	3
9	मोहन AIDS से पीड़ित था। उसका दाखिला एक स्कूल में कराया गया। उमेश उसी स्कूल में कक्षा IX का छात्र था। उसने देखा कि अन्य बच्चे उससे बात भी नहीं करते थे और न ही उसे अपने पास बैठने देते थे। उसने अपने प्राचार्य से स्वीकृति लेकर प्रार्थना सभा में AIDS पर एक संक्षिप्त भाषण दिया। उसके बाद बच्चों के व्यवहार में परिवर्तन आया और वे मोहन को दोस्त स्वीकार करने लगे। (a) AIDS के कोई दो विशेष लक्षण बताइये जिन्हें उमेश ने अपने भाषण में स्पष्ट किया होगा जिससे अन्य बच्चों के व्यवहार में परिवर्तन आया। (b) उमेश के व्यवहार द्वारा दर्शाए गए कोई दो मूल्य लिखिये। Mohan was suffering from AIDS. He was admitted in a school. Umesh who was a student of class IX observed that children were not ready to even talk to him. They did not allow him to sit near them. Umesh felt very bad. He asked his Principal and gave a small talk on AIDS in assembly, after which children started accepting Mohan as a friend. (a) Mention any two features about AIDS which Umesh must have clarified in his lecture that led to a change in other children's behaviour towards Mohan. (b) State any two values displayed by Umesh.	3
10	जीवों के स्थानीय नामों के प्रयोग से सम्बद्ध समस्या का उल्लेख कीजिए। इसका समाधान किस प्रकार किया गया? उस वैज्ञानिक का नाम लिखिए जिसने वह समाधान प्रस्तुत किया। Mention the problem which is associated with using local names of organisms. How was this resolved? Name the scientist who had introduced the above solution.	3
11	पाँच जगत वर्गीकरण दर्शाने के लिए प्रवाह चित्र बनाइये।	3

	Draw a flow-chart to show five kingdom classification.	
12	(a) निम्न आवृत्तियों में से किस आवृत्ति की ध्वनि मानव कर्ण के लिए श्रव्य है? 2 Hz, 5 Hz, 20 Hz, 200 Hz, 2000 Hz (b) किस प्रकार कुछ प्रजाति के शलभ स्वयं को उनके भक्षकों द्वारा पकड़े जाने से बचा पाते हैं? (a) The sound of which of the following frequencies is audible to human ears. 2 Hz, 5 Hz, 20 Hz, 200 Hz, 2000 Hz (b) How moths of certain families are able to escape capture by their predators?	3
13	ध्वनि के संदर्भ में आयाम, आवर्तकाल तथा तारत्व से क्या तात्पर्य है? With reference to sound what is meant by amplitude, time period and pitch.	3
14	घनत्व की परिभाषा तथा इसका SI मात्रक लिखिए। किसी ठोस का भार वायु में 100 g, जल में 75 g तथा तेल में 70 g है। तेल का आपेक्षिक घनत्व परिकलित कीजिए। Define density and give its SI unit. A solid weighs 100 g in air, 75 g in water and 70 g in oil. Calculate the relative density of the oil.	3
15	जब एक स्प्रिंग को झटका दिया जाता है तो इसमें 10 सैकंड में 20 कंपन उत्पन्न होते हैं। इसका आवर्तकाल तथा आवृत्ति ज्ञात कीजिए। उस स्प्रिंग में अनुदैर्घ्य तरंग किस प्रकार उत्पन्न की जा सकती है? 20 vibrations are produced in a slinky in 10 sec when a jerk is given to it. Find its time period and frequency. How can a longitudinal wave be produced in that slinky?	3
16	एक कारखाने में प्रत्येक 50 W के 10 बल्ब तथा प्रत्येक 70 W के पाँच पंखे 12 घण्टे प्रतिदिन कार्य करते हैं। बिजली की प्रतिदिन उपभुक्त यूनिटें परिकलित कीजिए। यदि बिजली के एक यूनिट का मूल्य ₹2 है तो कुल खर्चा भी ज्ञात कीजिए। In a factory 10 bulbs of 50 W each and 5 fans of 70 W each operate for 12 hours daily. Calculate the units of electricity consumed per day. Also find the total expenditure if 1 unit costs ₹ 2.	3
17	निम्नलिखित पदों को परिभाषित कीजिए : (a) परमाणु (b) अणु (c) आवोगाद्रो संख्या (d) संयोजकता (e) मोलर द्रव्यमान Define the following terms : (a) Atom (b) Molecule (c) Avogadro number	5

(d) Valency

(e) Molar mass

18

उपयुक्त पदों द्वारा सारणी भरिये :

रोग

रोगाणु

अंग जिस पर आक्रमण हो

स्थानांतरण का साधन

मस्तिष्कावरण शोथ

वाइरस

(a)

मल संदूषण

हेपेटाइटिस

(b)

(c)

दूषित जल

(d)

बैक्टीरिया

फेफड़े

(e)

दाद

फंगस

(f)

अप्रत्यक्ष संपर्क

(g)

वाइरस

फेफड़े

(h)

डेंगू ज्वर

(i)

संपूर्ण शरीर

(j)

Fill the table with appropriate terms :

Disease

Microbe

Target Organ

Mode of Transmission

Meningitis

Virus

(a)

Faecal contamination

Hepatitis

(b)

(c)

Contamination water

(d)

Bacteria

Lungs

(e)

Ringworm

Fungus

(f)

Indirect contact

(g)

Virus

Lungs

(h)

Dengue fever

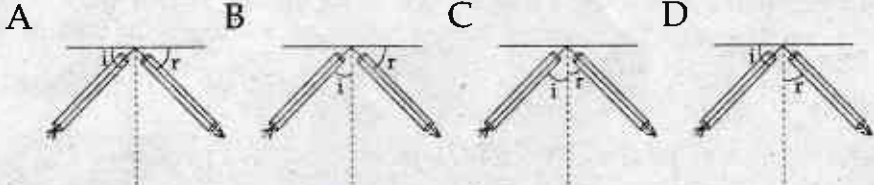
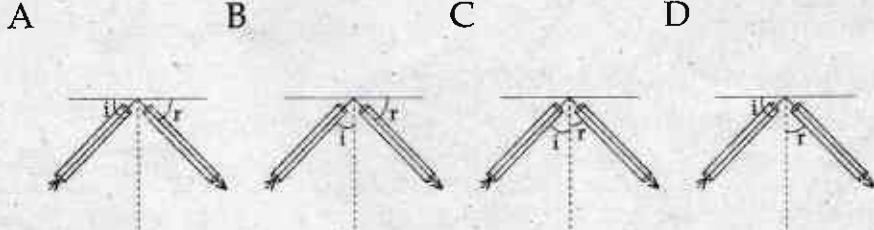
(i)

Whole body

(j)

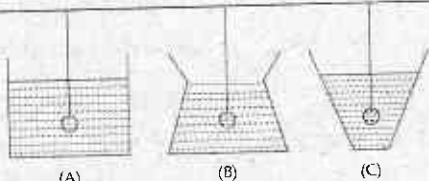
5

19	(a) जल-स्थलचर तथा पक्षियों के हृदय के कक्षों की संख्या लिखिए। (b) पक्षियों में पाए जाने वाले तीन अनुकूलन लिखिए जो उन्हें उनके जीवन में जीने के लिए मदद करते हैं। (a) Give the number of chambers in the heart of Amphibians and Aves. (b) Give three adaptations in Aves which help them to survive in their mode of life.	5
20	(a) प्रणोद तथा दाब में दो बिन्दुओं में विभेदन कीजिए। (b) एक पास्कल तथा एक न्यूटन से क्या तात्पर्य है ? यदि सम्पर्क के क्षेत्रफल को दोगुना कर दिया जाए तो दाब किस प्रकार भावित होगा ? (a) Differentiate between thrust and pressure. (give two points) (b) What is meant by 1 Pascal and 1 Newton? How will the pressure get affected if area of contact is doubled?	5
21	ध्वनि के संदर्भ में आवृत्ति तथा तरंगदैर्घ्य परिभाषित कीजिए। समझाइए कि प्रतिध्वनि क्या होती है? सोनार (SONAR) को पूर्ण रूप से लिखिए। पराध्वनि के दो अनुप्रयोग लिखिए। Define frequency and wavelength with reference to sound. Explain echo of sound. Write full form of SONAR. Give two applications of ultrasound.	5
भाग-ब/SECTION - B (मुक्तपाठ/ Open Text) विषय : मंगल के पर्यावरण को समझना Theme : Understanding the Environment of Mars		
22	मंगल तथा पृथ्वी में मंगलयान अभियान द्वारा सामने आई समानताएँ लिखिये। Give the similarities between Mars and earth as conveyed in Mars Orbiter Mission.	2
23	मंगल का आज का मौसम वर्ष भर प्रचण्ड रूप से परिवर्तित क्यों होता है? क्या मंगल का अक्षांशों का तापमान मानव के लिये सहनीय है? Why the Mars' current climate changes drastically during the year? Is the temperature on Mars at mid-latitude hospitable for humans?	3
24	पृथ्वी पर वायु दाब हर स्थान पर समान क्यों नहीं है? पृथ्वी तथा मंगल के वायु दाब में क्या अन्तर है? पृथ्वी पर अच्छे मौसम तथा तूफानी मौसम का क्या कारण है? Why the air pressure is not the same every where on Earth? What is the difference between the air pressure in Earth and Mars? What is the cause of fair weather and stormy weather on earth?	5

	भाग-स/SECTION - C	
25	चार छात्रों A, B, C और D ने ध्वनि के परावर्तन के नियमों का सत्यापन करने का प्रयोग किया। उन्होंने नीचे दर्शाए गए चित्रानुसार आपतन कोण तथा परावर्तन कोण को क्रमशः मापा :  जिस छात्र ने कोणों को सही मापा है वह है : (a) A (b) B (c) C (d) D Four students A, B, C and D performed the experiment to verify the laws of reflection of sound. The angles of incidence and reflection respectively measured by each of them are as shown in the diagram below :  The student who has measured the angles correct is : - (a) A (b) B (c) C (d) D	1
26	राकेश ने 20 N भार का एक ठोस घनाभ लिया जिसकी विमाएँ $0.2 \text{ m} \times 0.1 \text{ m} \times 0.05 \text{ m}$ थीं। उसने इस घनाभ को आटे के ऊपर क्रमशः फलक A, B, C पर रखा जिनकी विमाएँ क्रमशः $0.2 \text{ m} \times 0.1 \text{ m}$, $0.1 \text{ m} \times 0.05 \text{ m}$ और $0.2 \text{ m} \times 0.05 \text{ m}$ थीं। उसने प्रत्येक अवस्था के लिए दाब को मापा। सही परिणाम होगा : (a) 1000 Pa, 4000 Pa, 2000 Pa (b) 4000 Pa, 1000 Pa, 2000 Pa (c) 1000 Pa, 2000 Pa, 4000 Pa (d) 2000 Pa, 4000 Pa, 1000 Pa Rakesh took a solid cuboid of weight 20 N with dimensions $0.2 \text{ m} \times 0.1 \text{ m} \times 0.05 \text{ m}$. He successively placed it on wheat flour on faces; A, B, C of dimensions $0.2 \text{ m} \times 0.1 \text{ m}$, $0.1 \text{ m} \times 0.05 \text{ m}$ and $0.2 \text{ m} \times 0.05 \text{ m}$ respectively. He calculated pressure exerted by cuboid in each case. The correct result will be : (a) 1000 Pa, 4000 Pa, 2000 Pa	1

	(b) 4000 Pa, 1000 Pa, 2000 Pa (c) 1000 Pa, 2000 Pa, 4000 Pa (d) 2000 Pa, 4000 Pa, 1000 Pa	
27	कोई वस्तु जो 4 KHz आवृत्ति से कम्पायमान है, उसके द्वारा उत्पन्न टोन का तरंगदैर्घ्य है:- (यदि वायु में ध्वनि की चाल 344 m/s है) (a) 86.0 m (b) 80.6 m (c) 0.086 m (d) 8.06 m The wavelength of the tone produced by a body vibrating with a frequency 4 KHz will be:- (if the speed of sound in air is 344 m/s.) (a) 86.0 m (b) 80.6 m (c) 0.086 m (d) 8.06 m	1
28	एक फर्न के तने की अवस्थिति ज्ञात करते हुए विनय ने पाया कि यह : (a) भूमिगत तथा राइजोम है। (b) एक्सप्रिंग की भांति कुंडलित है। (c) पूरी तरह से अनुपस्थित है। (d) शाखित और तन्तुमय है। While locating the stem of fern, Vinay finds that it is : (a) underground and rhizome (b) coiled like a spring (c) totally absent (d) branched and filamentous	1
29	यदि द्रव्यमान संरक्षण का नियम सत्य है तो निम्न रासायनिक समीकरण में KCl और ऑक्सीजन के कितने-कितने अणु प्राप्त होते हैं? $2\text{KClO}_3 \rightarrow \text{KCl} + \text{O}_2$ (a) KCl = 2, O₂ = 2 (b) KCl = 1, O₂ = 3 (c) KCl = 2, O₂ = 3 (d) KCl = 3, O₂ = 2 If the law of conservation of mass is correct then what are the number of molecules of KCl and oxygen obtained in the following reaction? $2\text{KClO}_3 \rightarrow \text{KCl} + \text{O}_2$ (a) KCl = 2, O₂ = 2 (b) KCl = 1, O₂ = 3 (c) KCl = 2, O₂ = 3 (d) KCl = 3, O₂ = 2	1
30	किसी रासायनिक अभिक्रिया में निम्न में से कौन सा पदार्थ अवक्षेप के रूप में प्रकट होगा: (a) सिल्वर क्लोराइड (b) सोडियम क्लोराइड (c) सोडियम नाइट्रेट (d) बेरियम क्लोराइड In a chemical reaction, which of the following will appear as a precipitate :	1

	(a) Silver Chloride (c) Sodium Nitrate	(b) Sodium Chloride (d) Barium Chloride	
31	रूशिल ने एक पादप की जड़ का प्रेक्षण कर यह पाया कि उसमें सदृश आकार के जड़ों की सघन मात्रा है जो बिना किसी प्राथमिक या केन्द्रीय जड़ों के हैं। उसका नामकरण उसने इस रूप में किया— (a) अपस्थानिक जड़ (b) तंतुमय मूले (c) सहारा जड़ (d) मूसला जड़ Rushil observed the root of a plant and found extensive mass of similarly sized roots, without any primary or central roots and named it as : (a) stilt root (b) fibrous root (c) prop root (d) tap root		1
32	मटर के बीजों में पाए जाते हैं : - (a) एकबीजपत्र (b) अनेक बीजपत्र (c) दो बीजपत्र (d) कोई बीजपत्र नहीं Seeds of pea have : (a) one cotyledon (b) many cotyledons (c) two cotyledons (d) no cotyledon		1
33	प्यूपा से वयस्क में विकसित होने के दौरान परिवर्तन कहलाते हैं : (a) समावयवी (b) कलाबाजी (c) कायांतरण (d) अपमिश्रण Changes that occur during the development of adult from a pupa are called as : (a) isomerisation (b) somersaulting (c) metamorphosis (d) adulteration		1
34	एक दिए गए ठोस को कमानीदार तुला द्वारा हवा में तौला जाता है। तत्पश्चात उसको नीचे दर्शाए गए अनुसार तीन विभिन्न जल से भरे पात्रों A, B, तथा C में पूरी तरह से डुबोकर तौला जाता है। भिन्न-भिन्न पात्रों में ठोस का भार परस्पर किस प्रकार संबंधित होगा? अपने उत्तर के लिए उचित कारण लिखिए। A given solid is weighed in air using a spring balance. It is then weighed by immersing it fully in each of the three vessels A, B, and C containing water as shown		2

	 (A) (B) (C) How will the weight of the solid in different vessels be related to each other? Give suitable reason for your answer.	
35	एक कमानीदार तुला तथा मापक सिलिंडर का उपयोग करते हुए एक धात्विक गोले के पदार्थ का घनत्व ज्ञात करते समय एक छात्र ने निम्न पाठ्यांक नोट किए : (a) गोले का द्रव्यमान = 81g (b) (i) सिलिंडर में बिना गोले के जल स्तर का पाठ्यांक = 54 mL (ii) सिलिंडर में गोले के साथ जल स्तर का पाठ्यांक = 63 mL इन प्रेक्षणों के आधार पर गोले के पदार्थ का घनत्व परिकलित कीजिए। While determining the density of the material of a metallic sphere using a spring balance and measuring cylinder, a student noted the following readings : (a) Mass of the sphere = 81g (b) (i) Reading of water level in the cylinder without sphere = 54 mL (ii) Reading of water level in the cylinder with sphere = 63 mL On the basis of these observations, calculate the density of the material of the sphere.	2
36	कॉकरोच को उसके फाइलम में रखने के लिए उसका कौन सा विशिष्ट लक्षण हमारी सहायता करता है? कॉकरोच के कितने पाद होते हैं? Which characteristic feature of cockroach helps us to place it in its phylum ? How many legs are present in a cockroach?	2
	-000-	

OPEN TEXT MATERIAL

Theme – *Understanding the environment of Mars*

Abstract

Recent success of 'Mangalyan' (Mars Orbiter Mission) has made all of us proud of our scientists and engineers. The study of Mars' environment will help us in understanding more about our own environment. This text gives inputs on environment of Mars which can be correlated to the concepts learned by the students in class IX Science. The students are not supposed to memorize the facts and figures mentioned in the text, rather study the facts and figures with the above objectives in mind.

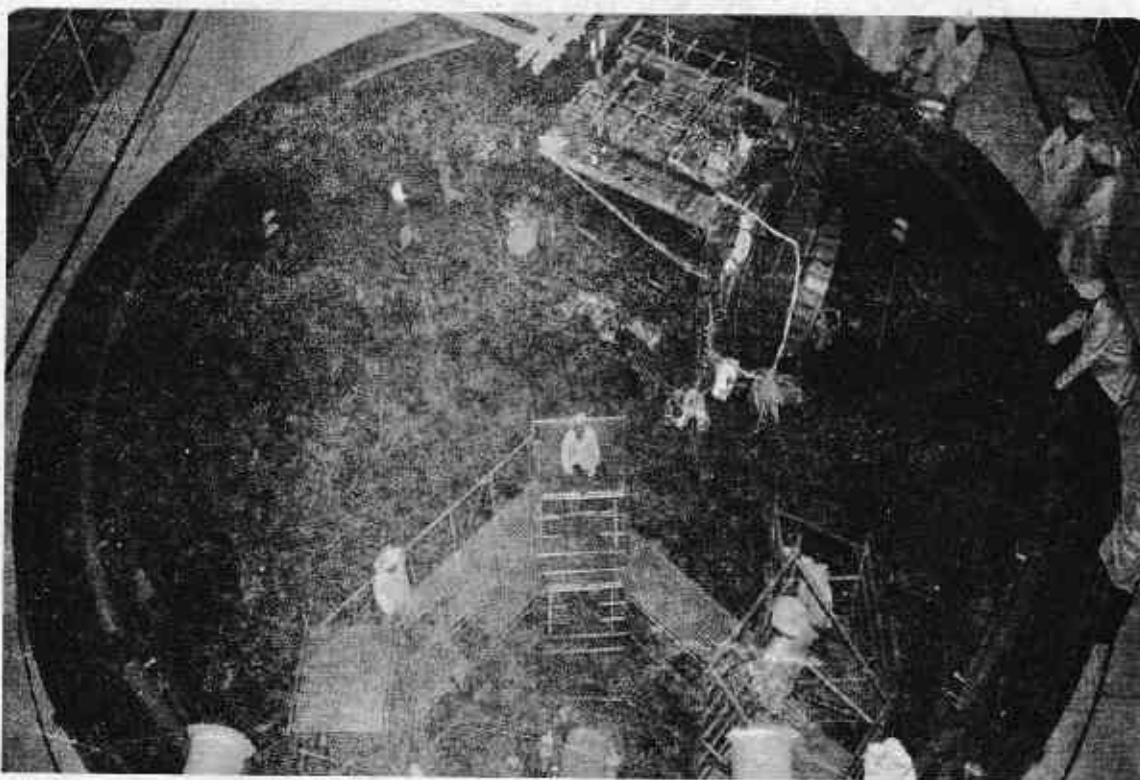


Fig. 1: Mars Orbiter Mission Spacecraft getting in to Large Space Simulation Chamber for Testing

Mars Orbiter Mission (M.O.M)

Mars tugs at the human imagination like no other planet. The conditions in Mars are believed to be hospitable since the planet is similar to earth in many ways. Mars and Earth have almost equal period of revolution around the axis. Mars takes 24 hours and 37 minutes to complete equal period of revolution around the axis. While Earth takes approximately 365 days to orbit round the Sun, Mars takes 687 days for an orbit around the Sun. The gravity of Mars is roughly one-third to Earth's gravity and it has a thin atmosphere with a pressure of 1% that of Earth. The atmosphere, water, ice and geology interact with each other to produce dynamic Martian environment as in Earth. Mars has surface features reminiscent of both the impact craters of the Moon, volcanoes, deserts and

polar ice of Earth. It inspires visions of an approachable world. For ages, humans have been speculating about life on Mars. But the question that is to be still answered is whether Mars has a biosphere or ever had an environment in which life could have evolved and sustained.

Mars Orbiter Mission is ISRO's first interplanetary mission to planet Mars with an orbiter craft designed to orbit Mars in an elliptical orbit. The mission is primarily a technological mission considering the critical mission operations and stringent requirements on propulsion and other bus systems of spacecraft. It has been configured to **carry out observation of physical features of mars and carry out limited study of Martian atmosphere** with following five payloads:

- ☆ Mars Colour Camera (MCC)
- ☆ Thermal Infrared Imaging Spectrometer (TIS)
- ☆ Methane Sensor for Mars (MSM)
- ☆ Mars Exospheric Neutral Composition Analyser (MENCA)
- ☆ Lyman Alpha Photometer (LAP)

The 'Mangalyan' or Mars Orbiter Spacecraft started its journey on 1st December 2013 and Indian Space Research Organization (ISRO) has been able to successfully do Mars Orbit Insertion operation on 24th September 2014. The trajectory (path) of travel of MOM is shown below.

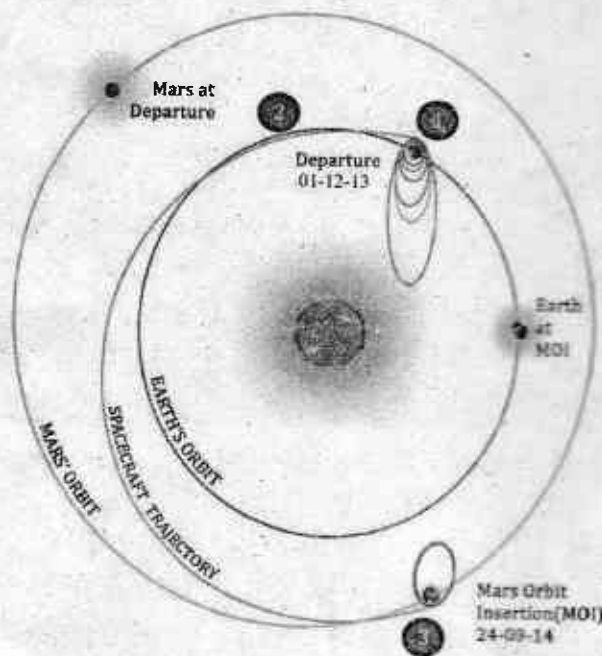


Fig. 2: The Trajectory of Travel of MOM

Time to celebrate

It is a great moment to all of us. The Following Press Release from ISRO gives us the gist of our accomplishment.

September 24, 2014

Mars Orbiter Spacecraft Successfully Inserted into Mars Orbit



Fig. 3: Prime Minister Mr. Narendra Modi addressing from ISTRAC as ISRO Chairman Dr. K. Radhakrishnan looks on

India's Mars Orbiter Spacecraft successfully entered into an orbit around planet Mars today morning (September 24, 2014) by firing its 440 Newton Liquid Apogee Motor (LAM) along with eight smaller liquid engines. This Liquid Engines firing operation which began at 07:17:32 Hrs IST lasted for 1388.67 seconds which changed the velocity of the spacecraft by 1099 metre/sec. With this operation, the spacecraft entered into an elliptical orbit around Mars. Prime Minister of India, Mr. Narendra Modi, was present at ISRO's Telemetry, Tracking and Command Network (ISTRAC) in Bangalore to witness this important event.

The events related to Mars Orbit Insertion progressed satisfactorily and the spacecraft performance was normal. The Spacecraft is now circling Mars in an orbit whose nearest point to Mars (periapsis) is at 421.7 km and farthest point (apoapsis) at 76,993.6 km. The inclination of orbit with respect to the equatorial plane of Mars is 150 degree, as intended. In this orbit, the spacecraft takes 72 hours 51 minutes 51 seconds to go round the Mars once.

Mars Orbiter Spacecraft was launched on-board India's workhorse launch vehicle PSLV on November 05, 2013 into a parking orbit around the Earth. On December 01, 2013, following Trans Mars Injection (TMI) manoeuvre, the spacecraft escaped from orbiting the earth and followed a path that would allow it to encounter Mars on September 24, 2014.

With today's successful Mars Orbit Insertion operation, ISRO has become the fourth space agency to successfully send a spacecraft to Mars orbit. In the coming weeks, the spacecraft will be thoroughly tested in the Mars orbit and the systematic observation of that planet using its five scientific instruments would begin.



Fig. 4: Mars Orbiter Spacecraft captures its first image of Mars, taken from a height of 7300 km

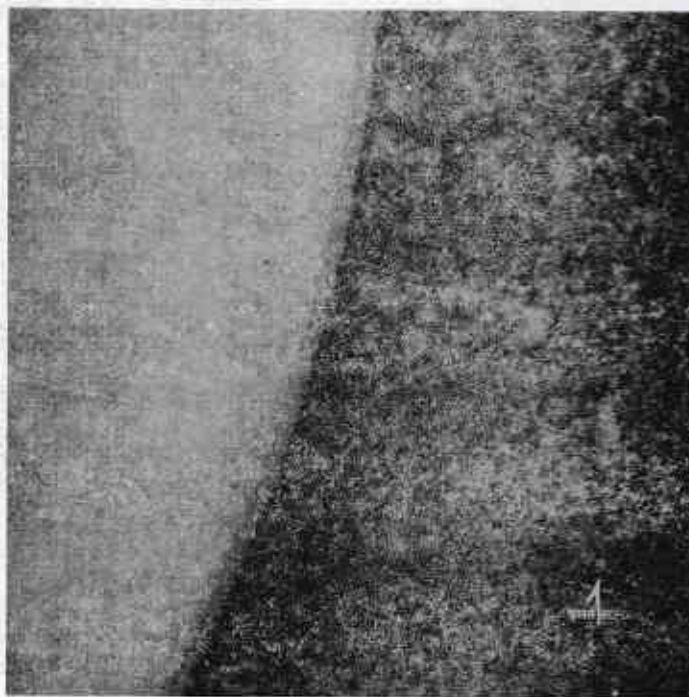


Fig. 5: Image taken using the Mars Colour Camera from an altitude of 8449 Km

Following are some facts on Mars available on the NASA website. The MoM may possibly verify the facts and get more information on Mars.

Mars Facts

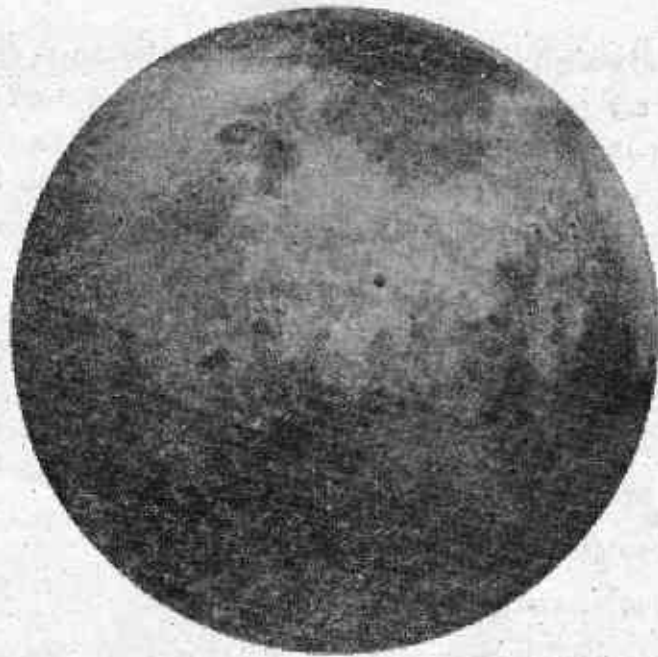


Fig. 6: Picture of Mars

Mars Climate

Scientists think that the climate on Mars 3.5 billion years ago was similar to that of early Earth: warm and wet. But because of chemical reactions between Mars' carbon dioxide atmosphere and water, most of its carbon dioxide was used up forming carbonate rocks. Earth is big enough and active enough that it has plate tectonics which recycles this carbonate back to carbon dioxide. Mars is too small (10 times less massive than the earth) and does not have any recycling of its carbonate. So now the Mars atmosphere is very thin, the temperature is very cold, and what water remains is either frozen in the Martian poles as permafrost or hidden in deep underground springs. Mars' current climate changes drastically during the year. It has seasons similar to the Earth's due the tilt of its axis. But because its orbit around the Sun is elliptical; the distance from the Sun varies about by 20% depending on where it is in its annual orbit. The seasons in one hemisphere (South) are more extreme while in the other (north) they are less extreme.

Temperature

The temperature on Mars may reach a high of about 70 degrees Fahrenheit (20 degrees Celsius) at noon, at the equator in the summer, or a low of about -225 degrees Fahrenheit (-153 degrees Celsius) at the poles. Obviously this is very inhospitable for humans, but it is also of some concern

for the electronics and mechanical parts of a Mars airplane and its instrumentation. In the mid-latitudes, the average temperature would be about -50 degrees Celsius with a nighttime minimum of -60 degrees Celsius and a summer midday maximum of about 0 degrees Celsius.

Humidity

Humidity is the amount of water vapor in the air. This varies from day to day and depends on the temperature: warm air can hold more water vapor than cold air. Humidity is measured as a percentage of the maximum amount of water that the air can hold at a given temperature. The greater the difference between the two temperatures, the greater the evaporation. When there is a lot of evaporation, the air is drier and the humidity is low. The instrument used to measure humidity is called a psychrometer.

On Mars, the air is saturated (100% humidity) at night, but under saturated during the day. This is because of the huge temperature difference between day and night.

To demonstrate this:

- ☆ Take a clean, dry jar and place the lid on it.
- ☆ Allow to stand 10 minutes in a shaded area and observe.
- ☆ Put it in a freezer for at least an hour.

Remove and observe. (At room temperature, the air inside the jar was not saturated, but in the cold freezer the air could not hold much water-it became saturated-and the water condensed and formed frost.)

Wind

Occasionally, winds on Mars are strong enough to create dust storms that cover much of the planet. After such storms, it can be months before all of the dust settles. The maximum wind speeds recorded by the Viking Landers in the 1970's were about 30 meters per second (60 miles an hour) with an average of 10 m/s (20 mph). Just as on Earth, at certain latitudes, the winds tend to blow in certain directions.

In Mars' northern mid-latitudes, wind blows from west to east just as it does in the United States. (Local variations of this can be caused by nearby mountains, large bodies of water, the season, etc.) Recent satellite images of Mars show that the dust storms have lessened, indicating that Mars winds have lessened, due to unknown causes. Scientists say that the planet is also getting colder.

Air Pressure

A barometer is used to measure air pressure. The average air pressure on Earth is 29.92 inches of mercury (or 1,013 millibars). This is more than 100 times Mars' average of 0.224 inches of mercury (7.5 millibars).

Air pressure is not the same everywhere on Earth. One reason is because temperature varies from place to place. When air heats up, air molecules move faster, pushing each other away and causing air to expand. With fewer molecules in the same amount of space, the air in that space weighs less: it exerts less pressure on the Earth. Cold air molecules are packed closer and exert more pressure on the Earth.

At any given location on Earth, the air pressure can vary about 10% whereas on Mars it can vary by as much as 50%. Mars' atmosphere is mostly carbon dioxide and therefore behaves differently than Earth's mostly nitrogen and oxygen atmosphere.

Changing air pressure is experienced as ears pop going up and down mountains or when flying in airplanes. Meteorologists, who try to predict the weather, know that a higher than average pressure reading usually brings fair weather while low pressure usually brings stormy weather.

We live on the bottom of an ocean of air. Air has weight and exerts pressure on us as a result of its weight. On each square inch of our bodies, there are 14.7 pounds of pressure. On the entire human body surface, the total air pressure varies from 10 to 20 tons! Just as ocean animals are not crushed by the weight of water above them, we are not crushed by the weight of the air because the inner pressure of our bodies pushing out equalizes the air pressure pushing down on us.

Linking to what you have learnt

Let's see the beautiful picture of our earth, the 'Mangalyan' captured on its Mars Mission. You may try to connect the information given above to what you have learnt in the Unit IV: Our Environment.



Fig. 7: Picture of Earth captured by Mangalyan on its Mission

Table 1:

	Mars	Earth
Atmosphere (composition)	Carbon dioxide (95.32%) Nitrogen (2.7%) Argon (1.6%) Oxygen (0.13%) Water vapour (0.03%) Nitric oxide (0.01%)	Nitrogen (77%) Oxygen (21%) Argon (1%) Carbon dioxide (0.038%) Water vapour (1%)
Atmosphere (pressure)	7.5 millibars (average)	1.013 millibars (at sea level)
Deepest Canyon	Valles Marineris 7 km deep 4,000 km wide	Grand Canyon 1.8 km deep 400 km long 149,597,891 kilometers
Distance from Sun (average)	227,936,637 kilometers	149,597,891 kilometers
Equatorial Radius	3,397 kilometers	6,378 kilometers
Gravity	0.375 that of Earth	2.66 times that of Mars
Largest Volcano	Olympus Mons 26 km high 602 km in diameter	Mauna Loa (Hawaii) 10.1 km high 121 km in diameter
Length of Day	24 hours, 37 minutes	Just slightly under 24 hours
Length of Year	687 Earth days	365 days
Polar Caps	Covered with a mixture of carbon dioxide ice and water ice	Permanently covered with water ice
Surface Temperature (average)	- 63 degrees C	14 degrees C
Tilt of Axis	25 degrees	23.45 degrees
Number of Satellites	2 (Phobos and Deimos)	1 (Moon)