Q.1) Consider the following regarding Trojan Asteroids

1. Trojan asteroids are trapped in stable gravity wells, called Lagrange points, which precede or follow a planet.
2. The most significant population of trojans are the Earth Trojans
3. NASA's Discovery Program named Pyche and Lucy is related to exploring Trojan ateroids

Which of the given statements is/are correct?

a) 1 and 3
b) 1 and 2
c) 2 and 3
d) 1, 2 and 3

Q.1) Solution (a)

Trojan asteroids are trapped in stable gravity wells, called Lagrange points, which precede or follow a planet.

Although scientists have discovered thousands of Trojan asteroids accompanying other planets, only one Earth-Trojan has been identified to date, asteroid 2010 TK7.

The most significant population of trojans are the Jupiter trojans. Although fewer Jupiter trojans have been discovered as of 2010, it is thought that they are as numerous as the asteroids in the asteroid belt.

A couple of trojans have also been found orbiting with Mars

NASA will send two spacecraft to explore asteroids in the hopes of revealing new information about the solar system's origins. Psyche will journey to what could be the metallic heart of a failed planet, and Lucy will investigate the Trojan asteroids near Jupiter.

Hint for this question-

http://www.thehindu.com/todays-paper/tp-national/NASA-sets-sights-on-asteroid-exploration/article17007697.ece

http://www.thehindu.com/sci-tech/science/large-asteroid-to-buzz-past-earth-on-april-19-nasa/article17894194.ece

Q.2) ISRO has recently launched a record of 104 satellites in one mission. Consider the following

1. Cartosat-2
2. Nanosatellites
3. Picosatellites
4. CubeSats

Which of the given satellites were parts of ISRO's mission?

a) 1 and 2
b) 1, 2 and 4
c) 1, 3 and 4
d) 1, 2, 3 and 4

Q.2) Solution (b)

In its thirty ninth flight (PSLV-C37), ISRO's Polar Satellite Launch Vehicle successfully launched the 714 kg Cartosat-2 Series Satellite along with other co-passenger satellites from Satish Dhawan Space Centre SHAR, Sriharikota. **This is the thirty eighth consecutively successful mission of PSLV. The total weight of all the 104 satellites carried on-board PSLV-C37 was 1378 kg.**

Only three of them are Indian satellites. (Cartosat-2 and two Indian Nanosatellites-less than 10kgs)

The PSLV will carry a main remote-sensing satellite in the Cartosat-2 series and two small spacecraft (INS), all for ISRO, and 101 small foreign commercial satellites.

The 88 cubesats are part of Planet's earth observation constellation of 100 satellites. They weigh around 5 kg each and are called 'Doves' or Flock 3p.

The main passenger on PSLV-C37 will be the fourth in the **Cartosat-2 series**, a very high resolution Earth observation satellite of about 650 kg, and occupies roughly half the space in the launch vehicle. It will carry **two more Indian nano satellites, INS-1A and INS-1B**, each weighing about 10 kg. They have a short lifespan of six to 12 months.

The 88 Doves would be released in sets of four cubesats. The other co-riders are cubesats or small specialised satellites of customers from **Israel, the UAE, Kazakhstan, the Netherlands, Switzerland** other than **US.** They will be released separately into their orbits at around 500 km from Earth.

Of the 101 foreign satellites launched**, 96 were from the U.S**. and one each from the other five countries.

Till now **Russia held the record of launching 37 satellites** in a single mission, in 2014, while the National Aeronautics and Space Administration of the U.S. launched **29 satellites** in one go in 2013.

Hint for this question-

http://www.livemint.com/Science/Pv2PxgBYrXPRHct4xfvdoM/Isro-creates-record-launches-104-satellites.html

http://indianexpress.com/article/explained/isro-pslv-c37-104-satellite-launch-cartosat-2-series-how-important-is-this-ton-4525227/

Q.3) NASA's series of Great Observatories satellites are four large, powerful space-based astronomical telescopes. Consider the following regarding it and select the correct match

1. The Hubble Space Telescope (HST) - Infrared spectrum
2. The Compton Gamma Ray Observatory (CGRO)- Gamma Rays and X-rays
3. The Chandra X-ray Observatory (CXO) - X-rays
4. The Spitzer Space Telescope (SST) - Visible light and Near-ultraviolet

Which of the given are correct?

a) 1 and 2
b) 2 and 3
c) 1, 3 and 4
d) 1, 2, 3 and 4

Q.3) Solution (b)

NASA's series of Great Observatories satellites are four large, powerful space-based astronomical telescopes. Each of the four missions was designed to examine a specific wavelength/energy region of the electromagnetic spectrum (gamma rays, X-rays, visible and ultraviolet light, infrared light) using very different technologies.

Dr. Charles Pellerin, NASA's Director, Astrophysics invented and developed the program. The four Great Observatories were launched between 1990 and 2003, and three remain operational as of 2017.

- The Hubble Space Telescop (HST) primarily observes visible light and near-ultraviolet. It was launched in 1990 aboard Discovery during STS-31. A servicing mission in 1997 added capability in the near-infrared range and one last mission in 2009 was to fix and extend the life of Hubble which resulted in some of the best results to date.

- The Compton Gamma Ray Observatory (CGRO) primarily observed gamma rays, though it extended into hard x-rays as well. It was launched in 1991 aboard Atlantis during STS-37 and was de-orbited in 2000 after failure of a gyroscope.
- The Chandra X-ray Observatory (CXO) primarily observes soft x-rays. It was launched in 1999 aboard Columbia during STS-93 into an elliptical high-earth orbit, and was initially named the Advanced X-ray Astronomical Facility (AXAF).
- The Spitzer Space Telescope (SST) observes the infrared spectrum. It was launched in 2003 aboard a Delta II rocket into an earth-trailing solar orbit; it was called the Space Infrared Telescope Facility (SIRTF) before launch. Depletion of its onboard liquid helium coolant in 2009 reduced its functionality significantly, leaving it with only two short-wavelength imaging modules

Hint for this question- http://www.thehindu.com/sci-tech/science/nasa-observatory-discovers-mysterious-cosmic-explosion/article17757869.ece

http://www.thehindu.com/todays-paper/tp-national/Double-delight-from-Indian-telescope-data/article17002410.ece

Note (Important)-

The National Aeronautics and Space Administration (NASA) of the United States has successfully completed building the largest space telescope — one that is 100 times powerful than the Hubble Space Telescope and may find the first galaxies that were formed in the early universe- **The James Webb Space Telescope will be the successor of NASA's 26-year-old Hubble.**

It is a joint project of the NASA, the European Space Agency and the Canadian Space Agency.

Q.4) Which of the following is/are correct regarding Project 75-I?

1. It is the project of Indian Navy that intends to acquire six Nuclear Scorpene class submarine
2. INS Khanderi is the one of the six submarines being built under Project 75-I
3. It features advanced Air Independent Propulsion (AIP) systems to enable them to stay submerged for longer duration and substantially increase their operational range

Which of the given statements is/are correct?

a) 1 and 2

b) 2 and 3
c) 1 and 3
d) 1, 2 and 3

Q.4) Solution (b)

The Project 75I-class submarine is a follow-on of the Project 75 Kalvari-class submarine for the Indian navy. Under this project, the **Indian Navy intends to acquire 6 diesel-electric submarines,** which will also feature **advanced Air Independent Propulsion (AIP)** systems to enable them to stay submerged for longer duration and substantially increase their operational range.

The first of the series INS Kalvari is completing sea trials and will be commissioned shortly. The other four submarines are expected to be launched at nine-month intervals after the INS Khanderi. **At Present, the Indian Navy operates only 13 conventionally powered submarines and two nuclear submarines (INS Arihant and INS Aridhaman).**

Q.5) Recently Astronomers have created the first map of the large-scale structure of the universe. This is based on

a) Quasar
b) Pulsar
c) Neutrino
d) Earth's magnetic field

Q.5) Solution (a)

- Astronomers have created the first map of the large-scale structure of the universe based entirely on the positions of quasars.
- Quasars are the incredibly bright and distant points of light powered by super-massive black holes.
- Because quasars are so bright, we can see them all the way across the universe.
- That makes them the ideal objects to use to make the biggest map
- The amazing brightness of quasars is due to the super-massive black holes found at their centres.
- As matter and energy fall into a quasar's black hole, they heat up to incredible temperatures and begin to glow. It is this bright glow that is detected by a dedicated 2.5-metre telescope on Earth.
- These quasars are so far away that their light left them when the universe was between three and seven billion years old, long before the Earth even existed.

- To make their map, scientists used the Sloan Foundation Telescope to observe an unprecedented number of quasars.

Hint taken from- http://www.thehindu.com/sci-tech/science/largest-map-of-universe-created/article18519811.ece?utm_source=RSS_Feed&utm_medium=RSS&utm_campaign=RSS_Syndication

Q.6) Neglected tropical diseases (NTDs) are a diverse group of communicable diseases that prevail in tropical and subtropical conditions in 149 countries and affect more than one billion people. Consider the following

1. Yaws
2. Rabies
3. Leprosy
4. Tuberculosis
5. Trachoma
6. Dengue

Which of the given are NTDs as per WHO?

a) 2, 3, 5 and 6
b) 1, 3, 5 and 6
c) 1, 2, 3, 5 and 6
d) 1, 2, 3, 4, 5 and 6

Q.6) Solution (c)

Neglected tropical diseases (NTDs) are a diverse group of communicable diseases that prevail in tropical and subtropical conditions in 149 countries and affect more than one billion people, costing developing economies billions of dollars every year. They mainly affect populations living in poverty, without adequate sanitation and in close contact with infectious vectors and domestic animals and livestock.

- Buruli ulcer
- Chagas disease
- Dengue and Chikungunya
- Dracunculiasis (guinea-worm disease)
- Echinococcosis
- Foodborne trematodiases
- Human African trypanosomiasis (sleeping sickness)
- Leishmaniasis
- Leprosy (Hansen's disease)

- Lymphatic filariasis
- Onchocerciasis (river blindness)
- Rabies
- Schistosomiasis
- Soil-transmitted helminthiases
- Taeniasis/Cysticercosis
- Trachoma
- Yaws (Endemic treponematoses)

Hint taken from- http://www.thehindu.com/sci-tech/health/in-ntd-fight-the-end-in-sight/article18516672.ece?utm_source=RSS_Feed&utm_medium=RSS&utm_campaign=RSS_Syndication

Q.7) Which of the following species is not monogamous?

a) Otters
b) Wolves
c) Gorillas
d) Gibbons

Q.7) Solution (c)

UPSC asked similar question in 2002 (So do not overreact ☺)

Monogamy is the common behavior among modern humans, in terms of relationships, but the idea is rare among mammals and birds.

While it is difficult to find monogamous relationships in nature, there are a few species which have adopted monogamy with great success. For instance, the prairie vole will mate exclusively with the first female he ever mates with.

Black vultures stay together as it is more beneficial for their young to be taken care of by both parents. They take turns incubating the eggs, and then supplying their fledglings with food. Black vultures will also attack other vultures that are participating in extra pair copulation, this is an attempt to increase monogamy and decrease promiscuous behaviour

Hornbills are a socially monogamous bird species that usually only have one mate throughout their lives, much like the prairie vole.

Other monogamous species include wolves, otters, a few hooved animals, some bats, certain species of fox, and the Eurasian beaver.

Chimpanzees, which have a promiscuous mating system, have large testes compared to other primates. Gorillas, which have a polygynous mating system, have smaller testes than other primates.

Hint taken from- http://www.hindustantimes.com/sex-and-relationships/monogamy-hyped-non-monogamous-relationships-are-just-as-successful/story-kINznR3s5SdsfzLife5fII.html

Q.8) Which of the following is not because of Capillary action?

a) Blotting of ink
b) Rising of ground water
c) Rising of water from the roots of the plant to its foliage
d) Spread of water drops on a cotton cloth

Q.8) Solution (b)

Capillary action is the ability of a liquid to flow in narrow spaces without the assistance of, or even in opposition to, external forces like gravity. Rising of ground water is not because of capillary action because external force is required to do so.

Capillary action is responsible for moving groundwater from wet areas of the soil to dry areas.

Hint taken from- http://www.thehindu.com/todays-paper/tp-in-school/LET%E2%80%99S-EXPERIMENT/article14594941.ece

Q.9) Chemical weapons are classified as weapons of mass destruction. One of the very famous WMD is Sarin, used as a chemical weapon due to its extreme potency as a nerve agent. It contains

a) Sulphur, Florine and Oxygen
b) Nitrogen, Sulphur and Oxygen
c) Phosphorous, Sulphur and Oxygen
d) Phosphorous, Florine and Oxygen

Q.9) Solution (d)

Nerve agents are a class of phosphorus-containing organic chemicals (organophosphates) that disrupt the mechanisms by which nerves transfer messages to organs.

Khan Shaykhun chemical attack; sarin gas was allegedly released in rebel-held Idlib Province in Syria by the Syrian military during a strike.

Blister agents	
Phosgene oxime	(CX)
Lewisite	(L)
Sulfur mustard (Yperite)	(HD)
Nitrogen mustard	(HN)
Nerve agents	
Tabun	(GA)
Sarin	(GB)
Soman	(GD)
Cyclosarin	(GF)
VX	(VX)
Blood agents	
Cyanogen chloride	(CK)
Hydrogen cyanide	(AC)
Choking agents	
Chloropicrin	(PS)
Phosgene	(CG)
Diphosgene	(DP)
Chlorine	(Cl)

Hint taken from- http://www.thehindu.com/opinion/op-ed/revisiting-indias-nuclear-doctrine/article17668024.ece

Q.10) Recently scientists have discovered a 'Super-Earth' which is the best place to look for signs of life outside of the Solar System about 40 light years away. The term super-Earth refers to

1. Mass of the planet
2. Habitability
3. Surface condition

Which of the given options is/are correct?

a) 1 and 2
b) Only 2
c) Only 1
d) 1, 2 and 3

Q.10) Solution (c)

A super-Earth is an extrasolar planet with a mass higher than Earth's, but substantially below the masses of the Solar System's ice giants, Uranus and Neptune, which contain 15 and 17 Earth masses respectively.

A super-Earth is a planet with a mass between 1 and 10 times that of Earth. **The super-Earth classification refers only to the mass of the planet**, and does not imply anything about its surface conditions or habitability.

The first super-Earths, two exoplanets with masses 4 times that of Earth, were found orbiting a pulsar called PSR B1257+12 in 1992.

Astronomers have discovered yet another planet, **called LHS1140b**, which is expected to be present in the Goldilocks Zone. It's not so far away, either. It is found orbiting around the star LHS 1140 some 40 light-years away

Hint taken from- http://www.thehindu.com/sci-tech/science/newly-discovered-super-earth-could-host-alien-life/article18152315.ece

Q.11) Which of the following is the hardest material?

a) Diamond
b) Wurtzite Boron Nitride
c) Lonsdaelite
d) Iron

Q.11) Solution (c)

For a long period of time, Diamond was titled as the hardest material on Earth but later on a new material, Wurtzite Boron Nitride (w-BN), took the title.

Unfortunately for w-BN, this tenure did not last long enough and a new allotrope of carbon (hexagonal diamond) known as Lonsdaelite emerged to claim the title.

Scientists have created synthetic diamonds that are harder than the regular ones and may help cut through ultra-solid materials on mining sites. Nano-sized Lonsdaleite is a hexagonal diamond only found at the site of meteorite impacts.

So, currently Lonsdaelite is the hardest known material on Earth.

Hint taken from- http://www.thehindubusinessline.com/news/science/synthetic-diamond-to-aid-mining/article9425275.ece

Q.12) Which of the following is the correct sequence of the given substances in the decreasing order of their densities?

a) Gold>Mercury>Steel
b) Steel>Gold>Mercury
c) Gold>Steel>Mercury
d) Steel>Mercury>Gold

Q.12) Solution (a)

Gold- 19.3 gm/cm3

Mercury- 13.6 gm/cm3

Steel- 7.7 gm/cm3

Q.13) The most common water-based antifreeze solutions used in automobile engines are mixtures of

a) Ethylene and Water
b) Propylene and Water
c) Ethylene glycol and Water
d) Ethanol and Water

Q.13) Solution (c)

The most common water-based antifreeze solutions used in electronics cooling are mixtures of water and either ethylene glycol (EGW) or propylene glycol (PGW). The use of ethylene glycol has a longer history, especially in the automotive industry.

Q.14) Assertion (A): Coal-based thermal power stations contribute to acid rain

Reason (R): Oxides of carbon are emitted when coal burns

a) Both A and R are true and R is correct explanation of A
b) Both A and R are true but R is not the correct explanation of A
c) A is true but R is false
d) A is false but R is true

Q.14) Solution (b)

Oxides of carbon are emitted but they do not contribute to acid rain. Why?

Acid rain results when sulfur dioxide (SO2) and nitrogen oxides (NOX) are emitted into the atmosphere and transported by wind and air currents. The SO2 and NOX react with water, oxygen and other chemicals to form sulfuric and nitric acids. These then mix with water and other materials before falling to the ground.

While a small portion of the SO2 and NOX that cause acid rain is from natural sources such as volcanoes, most of it comes from the burning of fossil fuels. The major sources of SO2 and NOX in the atmosphere are:

- Burning of fossil fuels to generate electricity. Two thirds of SO2 and one fourth of NOX in the atmosphere come from electric power generators.
- Vehicles and heavy equipment.
- Manufacturing, oil refineries and other industries.

Winds can blow SO2 and NOX over long distances and across borders making acid rain a problem for everyone and not just those who live close to these sources.

In the gas phase sulfur dioxide is oxidized by reaction with the hydroxyl radical via an intermolecular reaction:

$SO_2 + OH\cdot \rightarrow HOSO_2\cdot$

which is followed by:

$HOSO_2\cdot + O_2 \rightarrow HO_2\cdot + SO_3$

In the presence of water, sulfur trioxide (SO_3) is converted rapidly to sulfuric acid:

$SO_3 (g) + H_2O (l) \rightarrow H_2SO_4 (aq)$

Hint taken from- http://timesofindia.indiatimes.com/india/pollution-turning-countrys-rainfall-acidic-says-study/articleshow/57457470.cms

Q.15) Consider the following regarding Haemophilia

1. It is a genetic disorder
2. It leads to decrease in haemoglobin level
3. It leads to decrease in White Blood Cells
4. It impairs the body's ability to make blood clots

Which of the given statements are correct?

a) 1, 2 and 4
b) 1 and 4
c) 1, 3 and 4
d) 1, 2, 3 and 4

Q.15) Solution (b)

Haemophilia, also spelled hemophilia, is a mostly inherited genetic disorder that impairs the body's ability to make blood clots, a process needed to stop bleeding. This results in people bleeding longer after an injury, easy bruising, and an increased risk of bleeding inside joints or the brain

Hint taken from- http://www.thehindu.com/news/national/kerala/a-body-blow-for-haemophiliacs/article8205177.ece

Q.16) 'Urumin' was recently in new. What is it?

a) A sword with a flexible blade that snaps and bends like a whip
b) Peptide from Skin mucus secreted by a frog species native to Kerala
c) A recently developed measles rubella vaccine
d) None of the above

Q.16) Solution (b)

Researchers found the new peptide from Skin mucus secreted by a frog species native to Kerala.

The new peptide can be used to develop an anti-viral drug that can destroy various strains of flu, especially H1 flu virus which is responsible for swine flu pandemic.

Peptide is a chemical compound that is composed of a chain of two or more amino acids and is usually smaller than a protein. Many hormones and antibiotics are peptides.

Q.17) Consider the following statements regarding RTS, S

a) It is world's first malaria vaccine
b) It is world's first injectable vaccine for Ebola
c) It is world's first leprosy vaccine
d) It is world's first oral vaccine for rabies

Q.17) Solution (a)

Ghana, Kenya and Malawi will pilot the world's first malaria vaccine from 2018, offering it for babies and children in high-risk areas as part of real-life trials.

The injectable vaccine, called RTS,S or Mosquirix, was developed by British drugmaker GlaxoSmithKline to protect children from the most deadly form of malaria in Africa.

It is the world's first malaria vaccine and first regulator WHO approved vaccine against the mosquito borne disease.

Read More - http://www.malariavaccine.org/malaria-and-vaccines/first-generation-vaccine/rtss

http://www.thehindu.com/news/international/ghana-kenya-and-malawi-to-pilot-gsk-malaria-vaccine-from-2018/article18200927.ece

Q.18) Consider the following statements about THAAD

1. It is a missile defence system that is designed to intercept and destroy short and medium-range ballistic missiles in their final flight phase

2. Each THAAD system is comprised of interceptors, launchers, radar and a fire control unit

Select the correct statements

a) Only 1
b) Only 2
c) Both 1 and 2
d) Neither 1 nor 2

Q.18) Solution (c)

The Terminal High Altitude Area Defense, or simply abbreviated as THAAD, is a missile defence system that is designed to intercept and destroy short and medium-range ballistic missiles in their final flight phase. First proposed in 1987 and then finally deployed in 2008, the THAAD cannot be used as a form of attack against an enemy. Its role, by use of a powerful radar, is to simply track and destroy missiles before they are launched.

Lockheed Martin is the primary contractor in the THAAD project. Each THAAD system comprised of – interceptors, launchers, a radar, a fire control unit and support equipment. According to the company, the radar first intercepts an incoming missile. Any such threat is identified by those manning the system, who then fire a projectile from a truck, called the interceptor, at the missiles. Lockheed Martin said that finally by use of just the projectile's kinetic energy, the ballistic missile is destroyed. Reports claim that the use of kinetic energy makes the anti-missile system safer as it does not make use of warheads to destroy missiles.

Source: http://indianexpress.com/article/what-is/what-is-thaad-everything-you-need-to-know-about-the-us-anti-missile-system-4630087/

Q.19) Consider the following statements about Dawn spacecraft

1. It was launched as a part of NASA's New Frontiers program
2. It was launched with the mission of studying two of dwarf planet of the asteroid belt, Vesta and Ceres

Select the correct statements

a) Only 1
b) Only 2
c) Both 1 and 2
d) Neither 1 nor 2

Q.19) Solution (b)

There are currently three New Frontiers missions in progress: New Horizons, which was launched in 2006 and reached Pluto in 2015, Juno, which was launched in 2011 and entered Jupiter orbit in 2016, and OSIRIS-REx, launched in September 2016 towards asteroid Bennu for detailed studies from 2018 to 2021 and a sample return to Earth in 2023.

Dawn is a space probe launched by NASA in September 2007 with the mission of studying two of the three known protoplanets of the asteroid belt, Vesta and Ceres. It is currently in orbit about its second target, the dwarf planet Ceres. Dawn is the first spacecraft to orbit two extraterrestrial bodies, the first spacecraft to visit either Vesta or Ceres, and also the first to visit a dwarf planet, arriving at Ceres in March 2015

Q.20) Consider the following statements about Brown palm civet

1. It is endemic to India and Sri Lanka
2. It is listed as Least Concern on the IUCN Red List

Select the correct statements

a) Only 1
b) Only 2
c) Both 1 and 2
d) Neither 1 nor 2

Q.20) Solution (b)

The brown palm civet also called the Jerdon's palm civet is a palm civet endemic to the Western Ghats of India.

Brown Palm Civet has been recorded only in evergreen forest and in degraded and anthropogenic habitats over former evergreen forest, such as coffee plantations; there are no records from deciduous forests. It inhabits large contiguous forests, high-altitude montane evergreen forest patches or sholas, and small forest fragments amid plantations of tea and coffee; its occurrence is higher in medium-sized forest fragments contiguous with coffee plantations than in forest fragments isolated by non-woody habitat

Listed under CITES and Indian Wildlife Protection Act, 1972

IUCN Status- Least Concern

http://www.thehindu.com/news/cities/Coimbatore/elusive-brown-palm-civet-spotted-at-valparai/article17916941.ece?homepage=true