

FREE EXTRACT

Science Previous Year Questions

Three questions from inside the book, with the explanation written out as it appears throughout. Nothing here is abridged for the sample.

1

Kala-azar, which remains a public health concern in the plains of Bihar, is transmitted to human beings by the bite of

- (A) Female Anopheles mosquito
- (B) Female Aedes mosquito
- (C) Female sandfly
- (D) Tsetse fly

Answer: (C) Female sandfly

Kala-azar, or visceral leishmaniasis, is caused by the protozoan parasite *Leishmania donovani*, and the carrier is the female sandfly *Phlebotomus argentipes*, so option (C) is correct. The sandfly breeds in damp, cracked mud walls and in cattle sheds, and that simple fact explains why the disease has clustered in the northern districts of Bihar rather than in dry or urban areas, and why indoor residual spraying of houses and cattle sheds is the standard control measure. Learn the vectors as a set, because the paper mixes them freely: *Anopheles* carries malaria, *Culex* carries lymphatic filariasis and Japanese encephalitis, *Aedes* carries dengue and chikungunya, and the tsetse fly is an African insect that spreads sleeping sickness and is not found in India. Two follow-up points are worth memorising, as they have appeared in other state papers: the skin condition that can appear after apparent cure is called post kala-azar dermal leishmaniasis, and the elimination benchmark used in India is fewer than one case per ten thousand population at the block level. Remember also that kala-azar is a parasitic protozoan disease, not a bacterial or viral one, since that distinction is a common trap in matching questions.

2

Consider the following statements regarding cooking gas and vehicle fuel gas: 1. The main constituent of CNG is methane. 2. LPG is mainly a mixture of butane and propane. 3. A strong smelling substance is deliberately added to LPG so that leakage can be detected. Which of the statements given above are correct?

- (A) 1 and 2 only
- (B) 2 and 3 only
- (C) 1 and 3 only
- (D) 1, 2 and 3

Answer: (D) 1, 2 and 3

All three statements are correct, so the answer is (D). CNG, or compressed natural gas, is overwhelmingly methane, the simplest hydrocarbon, while LPG supplied in domestic cylinders is a liquefied mixture of butane and propane held under moderate pressure. The gases themselves are practically odourless, so an organic sulphur compound of the mercaptan family, usually ethyl mercaptan, is added as a warning agent; candidates often mark statement 3 wrong because they assume the smell is natural to the gas, which it is not. The most useful follow-up point is density: methane is lighter than air and disperses upwards on leaking, whereas LPG vapour is heavier than air and collects near the floor, which is why LPG leaks are more dangerous indoors and why cylinders are kept in ventilated spaces at ground level. Note finally that these are fuels valued for high calorific value and low particulate emission, which is the angle from which the environment section of the paper usually approaches them.

3

Consider the following statements about total internal reflection: 1. It takes place when light passes from a rarer medium to a denser medium. 2. The brilliance of a properly cut diamond is due to it. 3. Optical fibres carry signals by repeated total internal reflection. Which of the statements given above are correct?

- (A) 1 and 2 only
- (B) 2 and 3 only
- (C) 1 and 3 only
- (D) 1, 2 and 3

Answer: (B) 2 and 3 only

Statement 1 reverses the condition and is therefore wrong, which makes (B) the answer. Total internal reflection happens only when light travels from an optically denser medium to a rarer one, such as glass to air or water to air, and only when the angle of incidence exceeds the critical angle for that pair of media; going from rarer to denser the ray simply bends towards the normal and always refracts. Diamond has a very high refractive index and hence a small critical angle of roughly twenty four degrees, so light entering a well cut stone strikes the inner faces beyond that angle repeatedly and is thrown back out through the top, giving the sparkle. An optical fibre uses the same idea, with a core of higher refractive index surrounded by a cladding of lower refractive index, so the signal bounces along the length of the fibre with almost no loss. Keep the mirage in mind as the fourth standard example, where hot air near the road surface behaves as the rarer medium

The full book

Every question from the papers, each explained like this.

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