

Q11 C and F

A is false. The principle applies to all processes in a local region of spacetime.

B is false. The principle deals only with *local* regions.

C is true. See Unit 9, Section 4.2.

D is false. Such geodesic deviation is produced by spacetime curvature; a 'local' region is one of sufficiently small size for it to be undetectable.

E is false. The principle is an assumption, thought to be true in most circumstances, which played an important part in the development of general relativity. (See Unit 9, Section 6).

F is true. See Unit 9, Section 4.2.

Q12 B, D and E

A is false. The principle of equivalence applies to bodies subject to nuclear or electromagnetic forces and is therefore more general than the universality of free fall.

B is true. The universality of free fall is logically equivalent to the weak principle of equivalence, and this is a consequence of the principle of equivalence (see Unit 9, Section 4.2).

C is false. Being more general, the principle of equivalence might fail in ways that did not violate the universality of free fall.

D is true. See B above, a failure of one necessarily implies the failure of the other.

E is true. See Unit 9, Section 3.4.

F is false. The universality of free fall in a local region is a consequence of the principle of equivalence, so a failure of the former implies a failure of the latter.

G is false. Universality of free fall applies in extreme relativistic cases too.

Q13 B and C

A is false. For small speed, mechanics in a local inertial frame is Newtonian.

B is false. Non-rotating freely falling frames are *locally* inertial. (See Unit 9, Section 3.6.)

C is true. This statement combines B above with the well tested universality of free fall.

D is false. It runs counter to the basic idea behind the (poorly tested) principle of equivalence and the (well tested) weak principle of equivalence.

E is false. It is nonsense.

Q14 A, C, E Statement (b) is a fair summary of the equivalence principle, which implies the universality of free fall (statement (a)).