1. The Friedmann-Robertson-Walker metric

$$ds^2 = c^2 dt^2 - R^2(t)\left(\frac{dr^2}{1 - K\,r^2} + r^2\left(d\vartheta^2 + sin^2\vartheta\; d\varphi^2\right)\right)$$

describes a universe
A. with homogeneous and isotropic spacetime.
B. with homogeneous and isotropic space.
C. with homogeneous and isotropic time.

2. Energy conservation in general relativity
A. is a consequence of that theory.
B. is an independent assumption.
C. is no longer valid.

3. Scalar curvature of spacetime (Ricci’s scalar) can be zero while components of the Riemannian are nonzero.
A. This means that the metric of spacetime can be cast to Minkowski form simultaneously everywhere by a suitable coordinate transformation.
B. This means that spacetime is still curved.
C. This means that the energy density vanishes.

4. In accelerating coordinate systems
A. Christoffel’s symbols are nonzero.
B. the Riemannian is nonzero.
C. the metric tensor is Minkowskian.

5. If the 0,0 component of the metric is negative, then
A. this metric is nonphysical, does not descibe any existing gravitational field.
B. time becomes imaginary.
C. the corresponding coordinate system cannot be accomplished by real physical bodies.

6: Einstein’s equations
A. tell that spacetime's scalar curvature is proportional to energy density.
B. are partial differential equations which determine the metric tensor.
C. are only valid when homogeneity and isotropy is satisfied.

7. Gravitational red shift
A. can be observed under terrestrial circumstances.
B. causes the red color of sunsets.
C. up to now was not observed.

8. The Lagrangian density of gravitational field reads

$$-\frac{c^3}{16\pi k}\mathcal{R}\sqrt{-g}$$

where R stand for Ricci's scalar. This contains second derivatives of the metric, too.
A. Due to this fact Einstein's equations contain third derivatives of the metric, too.
B. Second derivatives appear linearly in R, they contribute only with surface terms to the action, therefore Einstein's equations contain at most second derivatives of the metric.
C. Due to this fact Euler-Lagrange equations of motion are first derivatives of Einstein's equations.

9. The energy-momentum tensor of matter reads

$$T_{ik} = \frac{2}{\sqrt{-g}}\left\{\frac{\partial\left(\sqrt{-g}\Lambda\right)}{\partial g^{ik}} - \frac{\partial}{\partial x^l}\left(\frac{\partial\left(\sqrt{-g}\Lambda\right)}{\partial\left(\frac{\partial g^{ik}}{\partial x^l}\right)}\right)\right\}$$

A. This expression is not symmetric in general case.
B. This expression can be derived from the fact that the action integral of matter is invariant under arbitrary coordinate transformations.
C. This expression can be derived from the fact that the Lagrangian density of matter does not depend explicitly on coordinates.

10. It is a feature of Einstein's equations that
A. Ricci's tensor is proportional to the energy-momentum tensor of matter.
B. they contain second time derivatives of all components of the metric tensor.
C. they imply, due to Bianchi's identity, that covariant four-divergence of the energy-momentum tensor of matter vanishes.

11. Divergence equation for the energy-momentum tensor of matter,

$$T^k_{i;k} = 0$$

does not imply conservation of the energy of matter, because
A. the energy-momentum tensor of matter is not symmetric.
B. in general relativity energy conservation is no longer valid.
C. energy of matter and gravitational field together is conserved.

12. Schwarzschild's metric, given by the interval

$$ds^2 = \left(1 - \frac{r_g}{r}\right)c^2dt^2 - r^2(d\Theta^2 + \sin^2\Theta d\varphi^2) - \frac{dr^2}{1 - \frac{r_g}{r}}$$

A. describes spacetime outside of a spherically symmetric mass distribution, in vacuum.
B. describes spacetime only within Schwarzschild's radius r_g.
C. describes spacetime only outside of Schwarzschild's radius r_g.

13. A body falling into a Schwarzschild black hole
A. never reaches Schwarzschild's radius r_g, according to a comoving observer.
B. crosses Schwarzschild's radius r_g within finite time, according to a comoving observer.
C. crosses Schwarzschild's radius r_g within finite time, according to a distant observer.

14. An observer, resting at a distance of $r=\frac{4}{3}r_g$ (Schwarzschild coordinates) from the center of a massive spherically symmetric body, observes a radio signal emitted from Earth. If the signal is emitted at frequency f_0, what frequency is it observed at?

A. $\frac{4}{3}f_0$

B. $\frac{1}{2}f_0$

C. $2f_0$

15. Equations of motion of a body, moving in a static, spherically symmetric gravitational field,
A. are completely different from those of the classic Kepler problem, they cannot be compared to that.
B. are identical with those of the classic Kepler problem.
C. differ from those of the classic Kepler problem such that a term proportional to $1/r^3$ appears in the expression of the effective potential.

16. Light deflection in a static, spherically symmetric gravitational field
A. is just the same we get when combining special relativity and newtonian gravity.
B. is twice as much we get when combining special relativity and newtonian gravity.
C. is the half of that we get when combining special relativity and newtonian gravity.

17. It is true for weak gravitational fields that
A. symmetric rotating bodies radiate polarized gravitational waves.
B. the absolute luminosity of radiated gravitational waves is proportional to the square of the third time derivative of the quadruple momentum tensor of the source.
C. the radiated gravitational waves are longitudinal waves.

18. An experimental evidence of general relativity is the perihelion wandering of Mercury, because
A. it contains the perturbation of other planets.
B. due to the $1/r^3$ term appearing in the effective potential, orbits would not be closed even in the absence of the perturbation of other planet.
C. it predicts twice of the classical value.

19. In Gravity Probe B experiment spherically symmetric tops were deployed to a satellite revolving on a polar orbit, because
A. such way drag could be excluded.
B. such way the effect of aurora could be minimized.
C. the axis of geodetic precession due to orbiting and that of the precession due to the rotation of the Earth (frame dragging) are perpendicular to each other, and thus the two effects can be separated.

20. Study of signals of the Hulse-Taylor pulsar uncovered that this pulsar is a member of a binary system whose orbital elements were determined. Existence of gravitational waves was proven by the fact that
A. the observed light deflection was consistent with theoretical prediction.
B. time period of orbiting was decreasing such a way that was consistent with decrease of energy due to radiated gravitational waves.
C. the observed periastron wandering was consistent with theoretical prediction.