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Practice Questions

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1. The term 'sustainable development' in engineering and construction means:

- A. Using the cheapest available materials to reduce project costs
- B. Building as quickly as possible to meet Qatar's growth needs
- C. Focusing only on economic growth without considering environmental impact
- D. Development that meets present needs without compromising the ability of future generations to meet their own needs

2. Grade B500 reinforcing steel used in Qatar has a characteristic yield strength of:

- A. 250 MPa
- B. 500 MPa
- C. 600 MPa
- D. 350 MPa

3. A 'kick-off meeting' at project start is held to:

- A. Formally launch the project, aligning all stakeholders on scope, schedule, responsibilities, and procedures
- B. Conduct the first site safety inspection
- C. Issue the Notice to Proceed
- D. Approve final design drawings

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4. BIM stands for:

- A. Building Information Modelling — a digital representation of the physical and functional characteristics of a facility
- B. Building Infrastructure Management
- C. Baseline Infrastructure Methodology
- D. Building Inspection Manual



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5. Workability of fresh concrete is commonly measured using which test?

- A. Compressive strength test
- B. Schmidt hammer test
- C. Slump test
- D. Water absorption test

6. The modulus of elasticity (Young's Modulus) of structural steel is approximately:

- A. 70 GPa
- B. 200 GPa
- C. 30 GPa
- D. 400 GPa

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7. Under QCS 2014, what action must a contractor take if historical artifacts or antiquities are discovered during excavation?

- A. Continue work carefully to avoid damage and report at end of working day
- B. Remove and secure artifacts before informing the Engineer
- C. Stop only that section of work and continue elsewhere on site
- D. Cease work, avoid disturbance, and immediately inform the Engineer

8. Darcy's Law in geotechnical engineering describes:

- A. Seepage velocity of water through soil as proportional to the hydraulic gradient and permeability coefficient ($v = ki$)
- B. The shear strength of cohesive soil
- C. Settlement of foundations on clay
- D. Compaction of granular fill

9. ISO 14001 is an international standard that relates to:

- A. Quality management systems
- B. Environmental management systems
- C. Occupational health and safety management
- D. Energy management systems

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10. The shape factor of a steel cross-section is defined as:

- A. Elastic section modulus divided by radius of gyration
- B. Gross area divided by net area
- C. Plastic section modulus (Z_p) divided by elastic section modulus (Z_e)
- D. Second moment of area divided by cross-sectional area

11. The principle of superposition in structural analysis states that:

- A. All members carry equal loads
- B. For a linear elastic structure, total effect of multiple loads equals the sum of individual effects
- C. Forces can only be added when parallel
- D. Deflections always equal bending moments divided by stiffness

12. Lateral earth pressure coefficient at rest (K_0) for a normally consolidated soil is approximately:

- A. $K_0 = 1 - \cos \phi$
- B. $K_0 = 1 - \sin \phi$ (Jaky's formula)
- C. $K_0 = \tan^2(45 - \phi/2)$
- D. $K_0 = \tan^2(45 + \phi/2)$

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13. According to QCS 2014, for epoxy-coated reinforcement bars, what is the maximum number of holiday (pinhole) defects permitted in any 300 mm length?

- A. Zero holidays
- B. One holiday
- C. Two holidays
- D. Five holidays

14. BOD (Biochemical Oxygen Demand) is measured over a standard period of:

- A. 5 days at 20°C (BOD₅)
- B. 7 days at 25°C
- C. 1 day at 37°C
- D. 28 days at 20°C



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15. A surge arrester (SPD) in an electrical system protects equipment by:

- A. Improving power factor during storms
- B. Diverting high-voltage transient surges (lightning or switching) safely to ground
- C. Disconnecting the supply during thunderstorms
- D. Measuring lightning strike frequency

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16. QCS 2014 defines the maximum chloride ion content (by weight of cement) in reinforced concrete as:

- A. 0.20%
- B. 0.10%
- C. 0.40%
- D. 0.60%

17. In structural engineering, 'dead load' refers to:

- A. The permanent static weight of the structure itself and fixed components
- B. Live loads from occupants and furniture
- C. Wind and seismic forces
- D. Temporary loads during construction

18. Weight of a 1 m³ block of reinforced concrete (unit weight 25 kN/m³) acting on its foundation is:

- A. 25 N
- B. 250 N
- C. 2,500 N
- D. 25,000 N

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19. The Project Management Plan (PMP) is best described as:

- A. A formal document defining how the project will be executed, monitored, controlled, and closed, integrating all subsidiary plans
- B. A financial plan only
- C. A simple task list for the project team
- D. The project schedule (Gantt chart) only



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20. In structural analysis, the moment at a fixed support of a cantilever beam subjected to a uniform distributed load (UDL) of w per unit length over span L is:

- A. $wL^2/2$ (hogging)
- B. $wL^2/8$ (sagging)
- C. $wL/2$
- D. $wL^2/4$

21. Ashghal is the Qatari public authority responsible for:

- A. Planning, designing, and delivering public infrastructure (roads, drainage, infrastructure projects)
- B. Regulating engineering licenses and professional registration
- C. Approving building permits for private development
- D. Operating Qatar's electricity and water networks

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22. Which of the following actions by an engineer would constitute a breach of professional ethics?

- A. Declining a project outside their expertise
- B. Reporting a public safety concern to authorities
- C. Accepting undisclosed gifts or commissions from contractors while acting as Engineer for the client
- D. Recommending a more cost-effective design solution

23. The water-cement (w/c) ratio in concrete primarily affects:

- A. Aggregate size and gradation
- B. Steel reinforcement yield strength
- C. Concrete strength and durability — lower w/c ratio gives higher strength
- D. Concrete setting time only

24. For an ideal gas undergoing a reversible adiabatic process:

- A. $TV = \text{constant}$
- B. $PV = \text{constant}$
- C. $P/T = \text{constant}$
- D. $PV^\gamma = \text{constant}$

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25. In surveying, a contour line on a map connects points of:

- A. Equal horizontal distance from a reference point
- B. Equal elevation above a datum
- C. Equal slope gradient
- D. Equal soil bearing capacity

26. In a centrifugal pump, the developed head is proportional to the square of:

- A. Fluid density
- B. Flow rate
- C. Impeller rotational speed
- D. Pipe diameter

27. Under QCS 2014, which of the following correctly defines 'Approved' in a contractual context?

- A. Verbally agreed by the Engineer
- B. Always requiring written approval from the Engineer
- C. Approved by the Contractor's own QA team
- D. Accepted practice in Qatar without formal documentation

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28. The maximum thermal efficiency of a heat engine operating between TH and TC is:

- A. TH/TC
- B. TC/TH
- C. $(TC - TH)/TC$
- D. $(TH - TC)/TH$ (Carnot efficiency)

29. A Class 1 (compact) cross-section in EC3 steel design can develop:

- A. Only 50% of the plastic moment
- B. Full plastic moment capacity (M_p) with sufficient rotation capacity
- C. Unlimited rotation without local buckling
- D. Only elastic moment capacity



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30. Under Qatar Law No. 2 of 2014, how long is an engineering consultancy firm's license valid?

- A. 1 year
- B. 3 years
- C. 5 years
- D. 2 years



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Answer Key & Explanations

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1. D — Development that meets present needs without compromising the ability of future generations to meet their own needs

Sustainable development (Brundtland Commission definition) balances economic, social, and environmental considerations — delivering projects that are viable today without depleting resources or harming the environment for future generations. It is a core pillar of Qatar National Vision 2030.

2. B — 500 MPa

B500B (per BS 4449:2005) has characteristic yield strength $f_{yk} = 500$ MPa. This is the standard deformed bar grade used in Qatar/UK per QCS 2014 and EC2.

3. A — Formally launch the project, aligning all stakeholders on scope, schedule, responsibilities, and procedures

A kick-off meeting formally starts the project, aligning Employer, Engineer/PM, and Contractor on objectives, scope, schedule, key contacts, communication protocols, and early deliverables.

4. A — Building Information Modelling — a digital representation of the physical and functional characteristics of a facility

Building Information Modelling (BIM) is a process supported by digital tools for creating and managing information about a built asset. A BIM model integrates geometry, specifications, costs, and schedule data in a coordinated digital environment.

5. C — Slump test

The slump test (BS EN 12350-2 / ASTM C143) measures fresh concrete workability/consistency by quantifying the vertical settlement (slump) of a standard concrete cone after removal of the mould.

6. B — 200 GPa

The modulus of elasticity (Young's Modulus) of structural steel is approximately 200 GPa (200,000 MPa or N/mm²), a fundamental property used in structural deflection calculations.

7. D — Cease work, avoid disturbance, and immediately inform the Engineer

QCS 2014 requires the contractor to immediately cease work, avoid disturbing the discovery, and inform the Engineer so that authorities responsible for antiquities can be notified.

8. A — Seepage velocity of water through soil as proportional to the hydraulic gradient and permeability coefficient ($v = ki$)

Darcy's Law states $v = ki$, where v is the seepage velocity, k is the coefficient of permeability, and i is the hydraulic gradient. It governs groundwater flow through soils and is fundamental to dewatering and seepage design.

9. B — Environmental management systems

ISO 14001 specifies the requirements for an Environmental Management System (EMS), helping organisations identify and control environmental impacts and continuously improve environmental



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performance.

10. C — Plastic section modulus (Z_p) divided by elastic section modulus (Z_e)

Shape factor $f = Z_p/Z_e$. For a rectangle $f = 1.5$; for an I-section $f \approx 1.15$. It represents reserve strength between first yield and full plastification.

11. B — For a linear elastic structure, total effect of multiple loads equals the sum of individual effects

For linear elastic structures, total deflection/stress caused by several loads equals the algebraic sum of effects of each load acting independently.

12. B — $K_a = 1 - \sin \phi$ (Jaky's formula)

Jaky's formula for normally consolidated soils gives $K_a = 1 - \sin \phi$, where ϕ is the effective friction angle. $K_a = \tan^2(45 - \phi/2)$ is the active pressure coefficient (Rankine); $K_p = \tan^2(45 + \phi/2)$ is the passive coefficient.

13. C — Two holidays

QCS 2014 limits epoxy-coated reinforcement to no more than two holidays (not visually discernible pinholes) per 300 mm length of coated bar.

14. A — 5 days at 20°C (BOD $_{5,20}$)

The standard BOD test (BOD $_{5,20}$) measures oxygen consumed by aerobic microorganisms over 5 days at 20°C. This is the internationally accepted standard period and temperature for comparing wastewater strength.

15. B — Diverting high-voltage transient surges (lightning or switching) safely to ground

Surge Protective Devices (SPDs) clamp transient overvoltages (from lightning or switching surges) to safe levels by diverting the surge current to earth, protecting sensitive electrical/electronic equipment.

16. C — 0.40%

QCS 2014 limits chloride content to 0.40% by weight of cement for reinforced concrete to mitigate corrosion of steel reinforcement.

17. A — The permanent static weight of the structure itself and fixed components

Dead load is the permanent, static gravitational load of the structure's own weight (self-weight of slabs, beams, columns, walls) plus fixed fixtures — it does not vary over time.

18. D — 25,000 N

Weight = unit weight \times volume = $25 \text{ kN/m}^3 \times 1 \text{ m}^3 = 25 \text{ kN} = 25,000 \text{ N}$.

19. A — A formal document defining how the project will be executed, monitored, controlled, and closed, integrating all subsidiary plans

The PMP (PMBOK) is the central governing document integrating all subsidiary plans (scope, schedule, cost, quality, risk, procurement, communications) and baselines.

20. A — $wL^2/2$ (hogging)

For a cantilever of span L carrying UDL w , the fixed-end moment = $wL^2/2$ (hogging). This is a fundamental structural analysis result applicable to overhanging slabs and balconies.

21. A — Planning, designing, and delivering public infrastructure (roads, drainage, infrastructure projects)

Ashghal (Public Works Authority) is Qatar's government authority responsible for planning, designing, and



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delivering public infrastructure including roads, bridges, drainage, and coastal works.

22. C — Accepting undisclosed gifts or commissions from contractors while acting as Engineer for the client

Accepting undisclosed gifts, payments or commissions from parties other than the client — while acting on behalf of the client — constitutes a bribe and breach of fiduciary duty, violating professional ethics codes.

23. C — Concrete strength and durability — lower w/c ratio gives higher strength

The water-cement ratio is the most critical factor controlling concrete compressive strength and durability. Lower w/c ratio produces stronger, denser, more durable concrete (Abrams' Law).

24. D — $PV^\gamma = \text{constant}$

In a reversible adiabatic (isentropic) process: $PV^\gamma = \text{constant}$, where $\gamma = C_p/C_v \approx 1.4$ for diatomic gases.

25. B — Equal elevation above a datum

A contour line is an isoline connecting all points of equal elevation (height) above a specified datum, used to represent terrain relief on a topographic map.

26. C — Impeller rotational speed

Pump affinity laws: $H \propto N^2$, $Q \propto N$, $P \propto N^3$. Head is proportional to the square of rotational speed N .

27. B — Always requiring written approval from the Engineer

QCS 2014 defines 'Approved' as always requiring written approval from the Engineer — verbal agreements are not sufficient for compliance purposes.

28. D — $(T_H - T_C)/T_H$ (Carnot efficiency)

Carnot efficiency $\eta = 1 - T_C/T_H = (T_H - T_C)/T_H$. No real engine can exceed this theoretical maximum.

29. B — Full plastic moment capacity (M_p) with sufficient rotation capacity

A Class 1 section can develop full plastic moment resistance (M_p) and has sufficient rotation capacity for plastic hinge formation without local buckling.

30. D — 2 years

Engineering consultancy firm licenses are valid for 2 years under Qatar Law No. 2 of 2014.



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